Developing a Scale to Measure Just About Anything: Comparisons across Groups and Individuals

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YALE UNIVERSITY

2004

Developing a Scale to Measure Just About Anything: Comparisons across Groups and Individuals

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by
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2004

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DEVELOPING A SCALE TO MEASURE JUST ABOUT ANYTHING: COMPARISONS ACROSS GROUPS AND INDIVIDUALS.

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In the beginning was the word, but how loud was it? Every sense: taste, smell, sight, sound, pressure, warmth, cold, irritation, pain is a continuum of experience for individuals and across them. We used the psychophysical technique magnitude matching to evaluate 139 common remembered sensations in 57 healthy men and women. Our subjects also rated a range of auditory and taste stimuli with the same method. We chose the normalizing stimulus (strongest nonoral sensation experienced) that best separated our pool into groups (taster status) we knew to differ based on known genetic and pathological differences among individuals; we then looked for sensations that did not vary in intensity across these groups. We present ten sensations (the loudness of a ticking watch and airplane, the pressure of a handshake, the brightness of the sun and the moon, the pain of a mild headache and a stubbed toe, the warmth of a hot light bulb and scalding water, the pungency of ammonia) that did not differ in perceived intensity among our subjects and cover a range of intensities within their common sensory worlds. We believe these ten sensations are a helpful step toward forming a ruler of sensations common to all. Such a ruler would have not only experimental but also clinical applications.

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Introduction

In the beginning was the word, but how loud was it? That the relative intensities of sensation vary according to who senses them is something we all understand: children grasp that a playground's cacophony can be unpleasant to their elders while some of those elders ask them to speak up when questioned. This phenomenon shouldn't be dismissed as a folly of sound. We're not surprised when friends require sweaters on a cold evening or refuse to set foot in a restaurant known for spicy food. Some people put on sunglasses to get a better look at something on a sunny day and some take them off. Every sense: taste, smell, sight, sound, pressure, warmth, cold, irritation, pain is a continuum of experience for individuals and across them. Doctors know this well: some patients take halting steps the day after a given surgery and some remain overcome by pain. There is an advantage in knowing how intense a patient's pain is as this facilitates its management, and rudimentary pain intensity scales are used throughout hospitals and doctors' offices. What if, though, a scale existed that could gauge pain intensity across patients? We understand intuitively that the 0-10 scale can't do this: some people hit 9 with a paper cut and some won't pass 4 post-thoracotomy. A scale meaningful across people would mean a patient in more intense pain could be identified as needing more intense treatment, the sort of treatment that might speed recovery.

Some people break legs and walk into the emergency room. Some people break legs and need EMTs to get them on a stretcher. Are there different sorts of leg fractures? Yes. Are there different sorts of patients? Yes. People who have broken more than one bone can vouch that every fracture does not necessarily feel the same, and this highlights that the intensity of fracture pain and discomfort (and emotional distress) vary across patients. Getting a handle on how intense pain is in each patient in a way that would allow the direct comparison of different patients could be an important step in patient care. It has not been done up to now because it was assumed it could not be done. It can.

This thesis is a demonstration of how the scaling techniques long used in the field of psychophysical investigation have progressed to a point where they can be used across the senses and across subjects. This means that, in medicine, we can get solid data comparing the relative experiences of our patients across patients—in a manner that can only enhance our ability to provide effective care.

What follows is a history of sensory scaling techniques used in human investigations as they form the backbone of the experiment presented. Data from this experiment will then be explained and their potential use in patient care outlined.

The ability to scale sensory continua has dogged scientists for generations. A 1000 Hz, 98 decibel blast is a 1000 Hz, 98 decibel blast, but we recognize that it may sound far more intense to one's grandson than to oneself. We recognize this because we accept that a certain auditory deficit may accompany the blooming of wisdom, but how do we go about quantifying perceived sound intensity? Our scale may start in silence, but if we have assimilated the idea that a given sound is of different perceived intensity to different people, where do we anchor our scale besides the bottom? For sound, we have decibel measurement. Decibels, named in honor of Alexander Graham Bell, form a logarithmic scale and can be measured mechanically. The logarithmic aspect of decibels means that for every measured 10 dB increase, a given sound's loudness increases ten times. The Centers for Disease Control-National Institute of Occupational Safety and Health consider a whisper to be 30 dBs, a ringing telephone to clock in at 80 dBs and a fire engine to register 120 dBs, the threshold for aural pain. But do fire engines sound the same to all they whiz past? How loud is that? We are again lost if we cannot say that the initial whisper was one-and-a-half times as loud to one schoolgirl as it was to another. And even this does not mean that each schoolgirl is capable of sensing the same range of decibels.

The sweetness of lemonade is similar: sips from the same glass will not be equally sweet to all sharing. The sense of taste, though, is singular among its siblings in that it arrives with an anatomical tool built-in to check our scales for it. Discovering this happy happenstance of anatomy has allowed us to look backwards at scaling methodologies and see them in a new—and brighter—light.

Taste blindness, the inability to detect certain bitter compounds, is a serendipitous discovery dating from 1931 [15]. While DuPont chemist Arthur L. Fox was transferring a quantity of phenylthiocarbamide (PTC) to a jar, some became airborne, and a colleague remarked on its bitterness while Fox tasted nothing. Thus began a series of experiments to determine the scope of what became known as taste blindness, after colorblindness. Fox and Arthur Blakeslee, a mycologist and geneticist, took PTC to the 1931 meeting of the American Association for the Advancement of Science and gathered taste responses from more than 2500 volunteers [8]. Fox's PTC crystals were bitter to 65.5% and tasteless to 28.0% (the remaining 165-odd souls ascribed other tastes to the crystals). When they described their findings in *The Journal of Heredity*, the journal included a piece of paper impregnated with PTC crystals; this PTC paper is the ancestor of the PROP (6-n-propylthiouracil) paper used in the experiment later described. PROP, chemically similar to PTC, is odorless, unlike PTC, and less toxic as well.

Threshold measures of PTC sensitivity, including family studies from the early 1930s [7], suggested that taste blindness is a simple Mendelian recessive trait. Relying on thresholds to gather information about the range of genetic sensitivity to PTC misses the breadth of the issue, though. While thresholds were helpful in separating the sensitivities of men (less) and women (more) to PTC, they failed to predict, never mind capture, the range of suprathreshold experience. Our lives, after all, are lived in the suprathreshold range: as with sound, we hear whispers, but we are likely to ask our friends to speak up if what they say seems interesting.

University of Pennsylvania psychologist Samuel Fernberger took to tackling this

in a paper published in early 1932 [14]. He presented his subjects with PTC crystals.

> They were told to swallow the substance ... and then report the experience in terms of one of the five following categories: tasteless, slightly bitter, bitter, very bitter, and extremely bitter. The category of 'tasteless' more or less defines itself; 'extremely bitter,' the other limiting category, was defined in terms of raw quinine....

We can agree on the importance of a zero ("tasteless"), but did Fernberger's "extremely bitter" mark a reasonable top notch? The answer is no, but there is no way Fernberger could have known.

Fernberger did know this:

> ... previous authors have spoken of the situation of indiscrimination of this compound as 'taste blindness' apparently on the analogy of color-blindness. In certain respects the two are analogous: both involve indiscrimination of a particular sensory quality for some individuals while the same stimulus arouses intensive sensation in others; both show degrees of sensory weakness from full sensitivity to total indiscrimination and discrimination in both cases has a hereditary basis. The analogy would perhaps be complete except for two conditions. In the case of color-blindness to certain qualities it has been found that the indiscrimination covers all variations of the fundamental quality. If one is color-blind to red and green there is difficulty with *all* reds and greens. In the present case it is reported that individuals who find this substance utterly tasteless are nevertheless able to taste other bitters ....

He did not know, however, could not know, in truth, that raw quinine, the top of his scale, his "other bitters," would be perceived as more bitter by those in his study who could taste PTC than by those who could not. We know this now, and we reached this place through magnitude estimation and magnitude matching.

Harvard's S. S. Stevens revolutionized the field of psychophysics. In a paper published to mark the 100th anniversary of physician-turned-psychophysicist Gustav Fechner's groundbreaking *Elemente der Psychophysik* [13], Stevens stepped in line with

the never-ending number of scientists who lament the wrong-headedness of those who came before [25]. Fechner had used the *jnd*, the just noticeable difference, to mark notches in intensity scales, and he believed these jnds pointed to a logarithmic relationship between stimulus and perceived intensity (akin to our decibel scale). Stevens argued that power functions more accurately capture that relationship. He wrote that "new techniques have made it plain that on some two dozen sensory continua the subjective magnitude grows as a power function of the stimulus magnitude." Stevens believed that the best scales for sensory stimuli have ratio properties and had earlier set to undoing Fechner by noting that if the jnd does indeed mark a unit of sensation, a scale based on jnds must have ratio properties. Fechner's scale did not. A stimulus perceived at 10 jnds above threshold is more than ten times more intense than one perceived at 1 jnd.

Stevens devised a method of ratio scaling called magnitude estimation (see [26]). In magnitude estimation's earliest days, experimenters presented subjects with the first stimulus in a series and assigned a number designating its intensity. Subjects were instructed to rank all stimuli following on a ratio scale in terms of that first sensation. An experimenter might first present a subject with a 1.0 M salt solution, declare it a 20, and explain that if the next stimulus were to taste twice as strong, it would be a 40, if it tasted half as strong, it would be a 10, and so on. Later, subjects were allowed to rate without anchors: subjects assigned numbers to stimuli based on their perceived intensities without regard to an initial experimenter-assigned number designation; after the first stimulus, subjects chose their own first number and multiplied or divided it to match later stimuli.

Though, across subjects, the numbers assigned to stimuli using magnitude estimation could be all over the map—subject Eve might assign 1M sucrose a 10 while subject Adam calls it 1000—they do reveal the perceived ratios among stimuli for each subject (a solution Eve finds one-tenth as sweet as that 1M sucrose will be a 1 on her scale; a solution ten times as sweet a 100). Normalization can help make these ratios

clearer by bringing the numbers assigned by a subject pool in line. We do this by assigning the data from each subject a factor by which we multiply each rating: this maintains the ratio properties of the magnitude estimate data each subject provided as his every rating is multiplied by the same factor. We might assign a given stimulus a certain number designation or use the average of ratings for a group of stimuli to assign the factor. In the above example, we might assign 1M sucrose a 100. To normalize Eve's sucrose rating we divide 100 by 10; to do the same for Adam we divide 100 by 1000. Eve's factor is 10, then, and Adam's is 0.1. The sucrose solutions Eve called 20, 25 and 15 are now 200, 250 and 150; if Adam assigned those same solutions 2000, 2500 and 1500, his numbers are now 200, 250 and 150. While normalization helps us better see the size of ratios *within subjects'* data, it cannot reveal differences *among* subjects. Eve's rating of the 1M sucrose solution, whether her raw 10 or her normalized 100, doesn't tell us whether her 10 is as strong as Adam's 1000 (or his 100, or his 75 or 7500). What, though, if we could find a stimulus that would be equal to all? Then we could normalize magnitude estimation data to that standard.

The key is to find such a standard, one independent of the stimuli of interest, and one we may have found in the experiment later described. In early studies, though, when there was little reason to assume that salt intensity and bitter intensity were linked (sensitivity to a single chemical group was believed the only difference between PTC tasters and nontasters), NaCl seemed such a standard [9]. Subjects would scale the stimuli of interest—say the bitterness of PROP, quinine and potassium chloride—with the standard stimulus as well—the saltiness of NaCl—using magnitude estimation. Magnitude estimate data from the standard stimulus could then be used to get a handle on where our bitters lay. The assumption is that the *ratio* between the stimuli of interest and the standard will reveal the perceived intensity of the bitters (in this example). The standard stimulus need not be perceived as equally intense by all subjects as long as, on average, it is equally intense to the *groups* of interest. If we use salt as our standard, we

have to assume that salt intensity is unrelated to bitter intensity; then, on average, each of the PROP groups will perceive salt as equally intense. If subject Peggy gives 1M NaCl a 50 and 0.001 quinine HCl a 30 while subject Frank gives the salt a 3 and the quinine a 2, we assume Peggy's 50 is the same as Frank's 3 and we can compare our pair of salt-bitter ratios. We can do the same thing, more or less, by using another sense—say hearing—instead of another taste. This is magnitude matching [20], a technique devised by L.E. Marks and J.C. Stevens. Using magnitude matching in the example described, we have to assume that if hearing and taste are truly unrelated (an issue explored later on), and if we have a large group scaling both taste and sound, the average hearing will be the same across subgroups we identify within our pool of tasters. Actually doing this, scaling the bitterness of stimuli using magnitude matching to sounds, demonstrated that a subject's perceived intensity of salt is not independent of the intensity she perceives when sampling bitter solutions, and so sound generally makes a better standard when studying PROP (although we must be careful of pitfalls here as well). Data collected using NaCl as the standard revealed a subset of tasters as "superperceivers" of bitterness—supertasters [1]; using sound as the standard revealed the magnitude of difference between tasters and supertasters to be still greater.

Returning to Fernberger and his scale, recall that it began at "tasteless" and went through "slightly bitter," "bitter" and "very bitter" up to "extremely bitter." We see, now, that by defining "extremely bitter" as the taste of raw quinine, Fernberger wasn't using the same scale for each subject. "Tasteless" is tasteless for everyone, but the taste of raw quinine is not the same for everyone just as a fire engine siren seems louder to some than to others. Fernberger's five-adjective scale is a five-point scale and is limited by the adjective at the top; this limitation works two ways. First, if we know the taste of raw quinine is not the same for each subject, then we know "extremely bitter" isn't the same either. The adjectives don't have the same meaning for every subject, a problem long encountered with labeled category scales and labeled visual analogue scales. Fernberger

may have felt he was doing an end run around the adjective problem by defining his top using a specific taste, but, while he recognized that taste blindness doesn't mean a tongue blind to PTC is also insensitive to quinine, he didn't know, as we now do, that quinine is less bitter to the taste blind than to those who can taste PTC/PROP. Also, by defining the top of the scale as he did, Fernberger insured his data suffered from a ceiling effect. Fernberger's mistake is not something from which his colleagues learned right away—witness the success of labeled category scales, especially today's 0-to-9 or 1-to-10. Whether 5-points or 10, labeled category scales run out of room near the top: the ceiling effect.

In Fernberger's experiment, a subject to whom PTC crystals were more bitter than quinine had nowhere to go with her PTC rating. She would have hit the scale's ceiling. This is the most obvious of ceiling effects, which are to some extent misnamed. A subject's experiences of intensity are related to one another. When a subject's most intense experiences have to be put at the top of the scale, lesser experiences must fall proportionately lower. This is the less obvious consequence of ceiling effects and leads to what we have called the reversal artifact. We will discuss this below and provide an example (Figure 1). Adjective-labeled scales—be they Fernberger's, the 10-point, Likert (when used with sensations or feelings), visual analogue—assume the adjective labels mean the same to all subjects. What we've learned so far, though, demonstrates that, across people, this is rarely the case *within a given sensation*. Stepping back from any example and considering one's own experience in a world among others makes this seem obvious. As revealed in the above discussion of ceiling effects, Fernberger's "extremely bitter" may be as bitter as things got for him, but raw quinine does not necessarily match the top bitter sensation for everyone. We can infer his tasteless is the same perceived intensity as ours and the same as his subjects', but, once we leave that zero perceived intensity, all bets are off.

Magnitude matching demonstrated this may not be so: we can gather information

about taste stimuli using magnitude estimation and, by correlating perceived intensity with stimuli from another modality, one that on average doesn't vary across groups of subjects, we can gather a very good idea of the ratios of perceived intensity among stimuli across subjects.

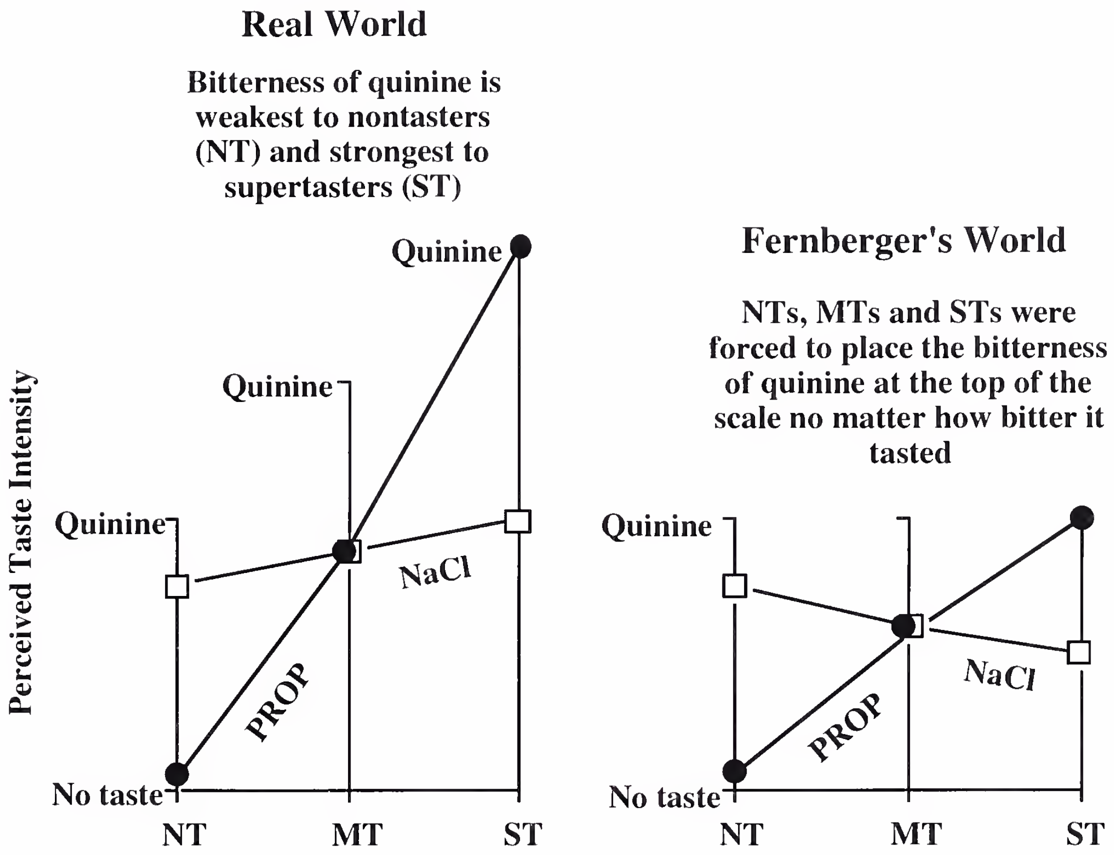


Figure 1. On the left, the bitterness of PROP and quinine as shown by magnitude matching and the magnitude-matching derived general Labeled Magnitude Scale (gLMS), both ratio scales. Note that quinine, which Fernberger used to define the top bitterness of his scale, is not equally bitter to all groups of tasters. Nontasters (NT) perceive the least bitterness, supertasters (ST) the most, and medium tasters (MT) an intermediate bitterness. The saltiness of NaCl is also associated with the ability to taste PROP, but the effect is smaller than that for quinine. On the right, the distortions induced by scaling mistakes like the one Fernberger made: if all subjects are forced to place the bitterness of quinine at the top of their scales, the medium and supertasters have to compress their ratings for NaCl proportionately. This causes the reversal artifact: the saltiness of NaCl appears most intense to nontasters and least intense to supertasters. Modified from [12].

The 1990's arrived with two developments that have had a serious impact on scales used to gauge perceived intensity, especially those used with taste. In alphabetical order, the developments were Marks's discovery of context effects and I. J. Miller's simple technique for measuring fungiform papillae density on the tongue.

Marks [19] demonstrated that perceived intensities vary as a function of the intensities preceding: a strong taste will cause a sound to be perceived as stronger than it would had it followed a moderate taste. Recognizing the impact of context effects on sensory data has changed the way we run experiments: PROP comes last in our taste studies now, lest it raise the numbers assigned to later stimuli for subjects sensitive to it, and we always begin with sound. This methodological advance allowed for studies which show most taste stimuli are most intense to supertasters [2, 3].

Miller and his student Reedy discovered a beautiful quirk: the surfaces of fungiform papillae do not absorb dye as the other surfaces of the tongue do, but the taste pores on these papillae do [21]. Parsing apart daily experience shows this to be true: children with access to colored candies have spotted tongues. In the lab, this means a quick swab of dye (we use blue food coloring for contrast) will adhere to the cell surfaces surrounding the fungiform papillae, rendering the unstained structures housing taste buds relatively easy to count on their darkened surroundings. Stained tongues mean fungiform papilla density can, in general, be assessed with a flashlight and magnifying glass. Further magnification reveals that, while the greater surface of the fungiform papillae are stain-free, the taste pores, conduits to the taste buds, hold dye. Miller and Reedy demonstrated that PROP tasters have a greater density of fungiform papillae on their tongues than nontasters [21] and later work demonstrated that supertasters have the most fungiform papillae of all [5]. The same relationship holds for taste pores: supertasters have the most, nontasters the fewest. But anatomy is not destiny in as much as it does not always reflect pathology. Anatomical measures did, however, shore up the early observations that women are more sensitive to the bitterness of PTC/PROP than men; in

some recent data, over 10% of examined women had more fungiform papillae than any of the men.

That fungiform papillae density can be correlated with taste intensity is not the end of this measure's usefulness. It provides insight into genetic variation for perceived intensity of other oral stimuli as well. Only 25% of fungiform papilla innervation is taste (carried by the chorda tympani branch of cranial nerve VII); the rest is trigeminal (cranial nerve V) innervation coding for pain and touch sensations [23, 28]. Supertasters, as one would predict, perceive the most burn from oral irritants like capsaicin (chili peppers) and ethanol just as they perceive the most tactile sensation (oiliness, thickness) from fats in foods [11, 22, 27].

Around the same time as Marks's and Miller's work, B. G. Green devised his Labeled Magnitude Scale (LMS) [17, 18]. Green set out to build on Gunnar Borg's [10] category-ratio scale; he wanted an adjective-labeled scale for oral sensations with ratio properties meaningful across individuals, a means of gathering sense-specific data without the need for normalization. The ratio properties of Green's LMS are conferred by the spacing between the adjectives; the spacing was derived by asking subjects to assign intensity ratings to various stimuli and remembered sensations *and* various adjectives. Between the zero bottom and "strongest imaginable" top, Green anchored "barely detectable," "weak," "moderate," "strong" and "very strong." The upper and lower anchors brought meaning to the intervening adjectives in a way previous scales lacked.

The strength of Green's scale, though, depends on context, on how it is described to those who will use it. Green defined "strongest imaginable" as the strongest imaginable oral sensation, but we know the strongest imaginable oral sensation varies according to the genetic array each of us is born with (as well as the head trauma and viral infections that affect our oral sensations). Change the top label from "strongest imaginable oral sensation" to the "strongest imaginable sensation of any kind," however, and the scale gets better. We call this scale the generalized Labeled Magnitude Scale (gLMS). Data

from the experiment later described, however, will demonstrate that "strongest imaginable sensation of any kind" is *not* of uniform meaning across people. At the time Green was developing his scale, the correlation between fungiform papilla density and perceived taste intensity was being studied, and anatomical measures began to be used to validate the gLMS and other scales (some more, some less) used to demonstrate the genetic variation.

Genetic variation, reflected in perceived intensity of taste stimuli rated using the gLMS, correlates with fungiform papillae density. This is no longer true when we use a 10-point scale (see Figure 2 for an example using sucrose). Placing the two scales together, as they are in the figure below, illustrates the fact that good scales will show this correlation and poorer scales will not. The scale demonstrating the clearest correlation will be the best. We could, of course, use taste pore density to test these scales as well, but the measurement of taste pore density is far more labor intensive and requires special equipment.

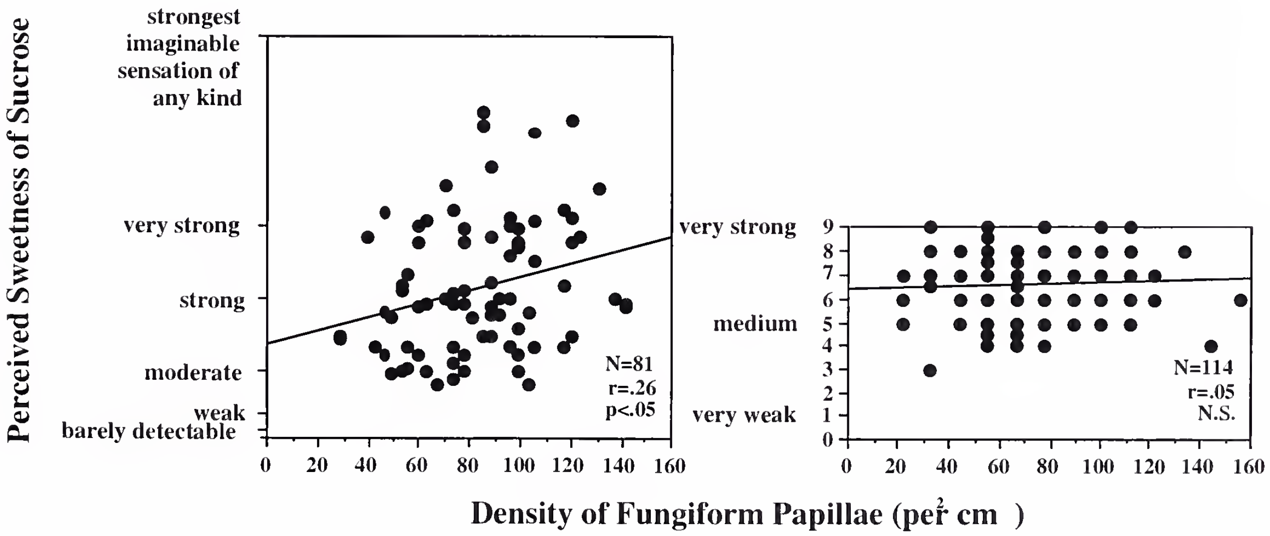


Figure 2. Above, two graphs show the perceived intensity of 1M sucrose versus density of fungiform papillae. The graph on the left has data gathered using the gLMS to measure perceived sweetness. The graph on the right shows data gathered using a nine-point scale. From [12]

Failing to anchor the top of a scale so it means the same to all subjects can produce erroneous negative correlations between taster status and stimulus intensity: the reversal artifact. For an example of this, we return to Fernberger. Recall that by anchoring his scale at the top with "raw quinine," Fernberger treated his data as if nontasters, medium tasters and supertasters all perceived the same intensity of bitterness from quinine. They didn't. For a moment, we will consider the consequence of this for an experiment Fernberger might have done. We now know that saltiness does not vary as much across PROP groups as does quinine. This means that the ratio of quinine to salt is largest for supertasters and smallest for nontasters. Since Fernberger forced the ratings for quinine to be equal for all subjects, had he asked his subjects to rate salt, he would have seen a bizarre result: nontasters would have rated salt as saltier than supertasters did. Figure1, from above, illustrates this.

Data collected from control subjects has allowed us to assess the effects of various pathologies on taste and other oral sensations. When a patient's perceived intensity ratings for taste or tactile stimuli are well below those we expect for someone with a similar array of fungiform papillae, we expect pathology to explain the dissociation. We know that, in extreme cases, such as when the chorda tympani nerve is cut in surgery, fungiform papillae remain on the tongue though their service as a first stop for taste is meaningless (unpublished data: Janjua, Schwartz). Head trauma can result in nerve damage to similar effect. Ear infections and upper respiratory tract infections can also affect taste [6, 24] as do hormonal changes [4, 16]. Figure 3 shows the correlation between bitterness and fungiform papillae density on the anterior tongue from three volunteers. Pictured are three circles. These show the fungiform papillae in a 6 mm circle near the tip of the tongue. The left-hand circle is from a normal nontaster tongue; the middle from a normal supertaster tongue. The right-hand circle is from the tongue of a supertaster who has suffered viral damage; her tongue shows fungiform papillae density analogous to the other supertaster though her bitter perception is less than the

nontaster's. Taste pathology and hormonal variation will alter taste experience but not density of fungiform papillae; density of taste pores, however, may be altered.

Although fungiform papilla density is a wonderful tool when studying scales, we have come to depend on an even more useful method. As noted above, trauma and viral insults can cause fungiform papilla density and perceived taste intensity to dissociate. Measurements of perceived PROP bitterness provide an index not only of genetic variation but also of pathology. We can thus use perceived PROP bitterness to scale other tastes and even to separate groups of tasters—NTs, MTs and STs.

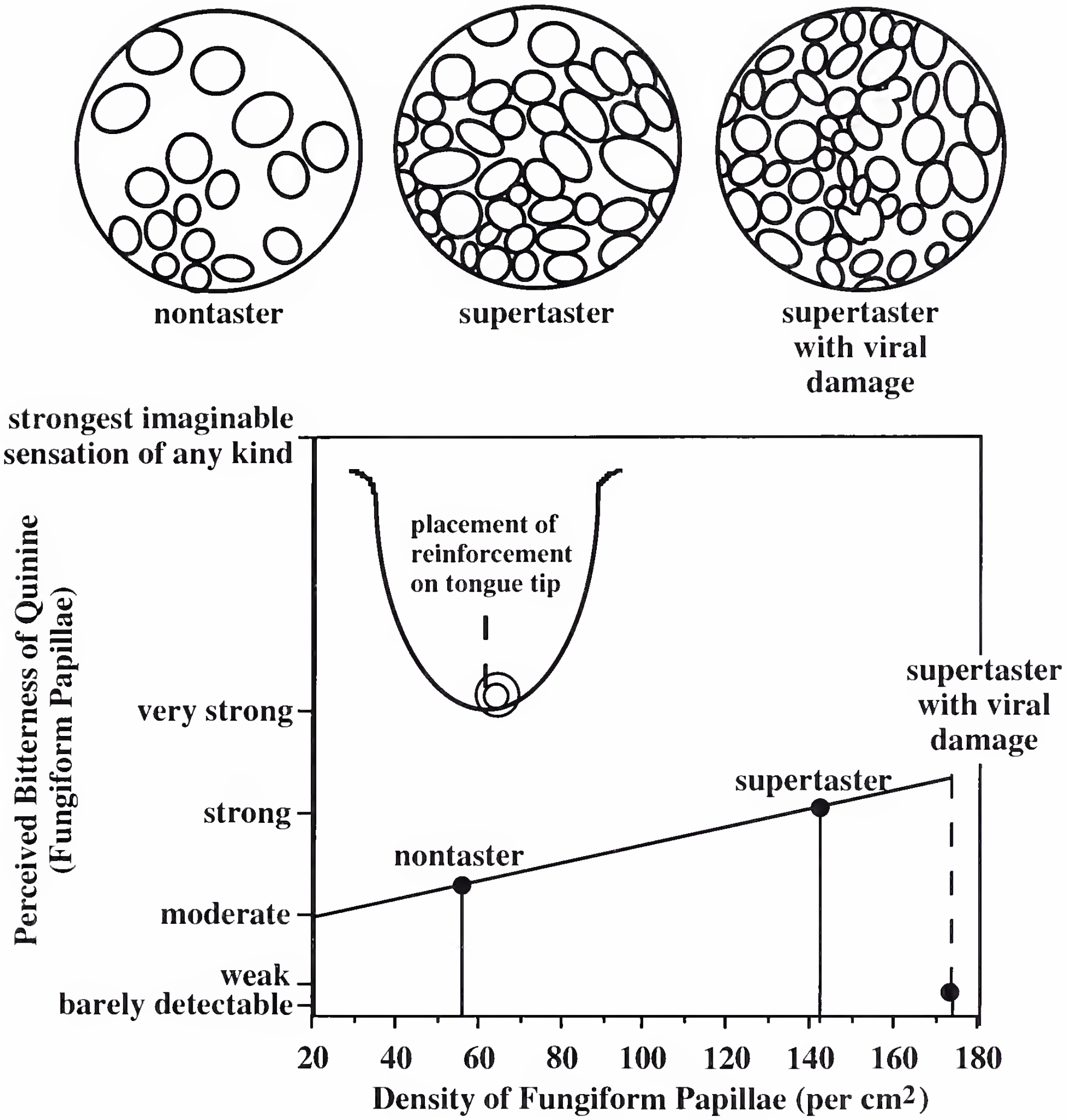


Figure 3. The graph above shows the regression line for the perceived bitterness (scaled using the gLMS) of 0.001M quinine hydrochloride swabbed onto the anterior tongue. Filled circles on the line indicate three subjects' bitterness ratings; the circles above the graph correspond with the subjects below and show enlargements of the fungiform papillae found within a 6 mm circle by the midline of each subject's anterior tongue. Figure from [12]

The impetus for the LMS was the evaluation of oral sensation. The experiment described in this thesis uses Green's *approach* to scale construction *but applies it to a*

broad range of sensations. Including taste among a range of stimuli allowed us to link the bitterness of black coffee with either a severe headache or broken bone (supertasters) or the brightness of the moon and that of a fluorescent light (nontasters). By ignoring the notion that sensory experiences across people could not be compared and fashioning an experiment which drew upon both the triumphs and errors of those who tried before, we present what seems, right now, the best method for collecting meaningful sensory data from men and women "off the street," some of them supertasters, some of them nontasters and most of whom fall in the middle. In our study, some subjects had had such painful experiences that they lost consciousness; some were quite aware that their lives had been relatively pain-free. One grew up in Iceland: between hot springs and snow; several came from San Diego, home of relentless sunshine. All were relatively young—19 to 49 years old—and there is reason to believe that time will broaden sensory experience, providing greater pain, colder days, sweeter tastes. We learned that pursuing valid measures of sensory intensity revealed new insights and challenged long-held views, some of them our own.

Statement of Purpose

The purpose of this thesis was to evaluate a broad range of sensations across subjects. Beyond the basic and common sensations of this study, which we chose as a starting point, a means of gauging dyspnea, for example, would allow pulmonologists and primary care physicians to strip fear and anxiety from inherent breathlessness and choose drugs accordingly.

Methods

Members of the Yale community were recruited by posters and word-of-mouth to participate in our study. Each received information sheets describing the study prior to participation. The Human Investigation Committee of the Yale University School of Medicine decided this was preferable to signed consent forms as the experiment was relatively noninvasive and all stimuli were part of most subjects' daily lives. Fifty-seven individuals, 31 women and 26 men, ranging in age from 19 to 49, completed the experiment.

A single examiner began the formal investigation with each subject by describing the experiment and explaining magnitude estimation using examples of distance and brightness. Subjects were asked repeatedly if they had any questions and all were answered as they arose. Subjects were also assured they could leave the study at any time and would be compensated for their time regardless. Demographic data were collected: age, sex, height, weight, race, number of children and, for women, date of last menstrual period. The examiner also asked each subject four questions to determine extent of possible damage to his or her sense of taste. Each question and its four possible answers is listed below.

1. Do you ever lose your sense of taste with a cold or the flu?

    Possible answers: (1) never, (2) occasionally, (3) sometimes, (4) always.

2. Have you ever had a persistent taste in your mouth?

    Possible answers: (1) never, (2) occasionally, (3) sometimes, (4) always.

3. Have you ever suffered a head injury?

    Possible answers: (1) no, (2) yes but not serious, (3) a concussion or loss of consciousness, (4) both concussion and loss of consciousness with memory loss.

4. Have you ever had an ear infection?

    Possible answers: (1) no, (2) yes but not serious, (3) yes requiring antibiotic

treatment more than once, (4) yes requiring tube placement.

Subjects were then given headphones connected to a modified (permitting equal sounds to both ears at once) Beltone sound machine and instructed in magnitude estimation again. They were told they would hear a tone and should assign a number to it. If the next tone sounded three times as loud, it should get a number three times as large; if it sounded one-third as loud, it should receive a number one-third as large. Two sets of five tones were presented in random order: 50, 62, 74, 86 and 98 dB. Subjects did not record their own numbers for the perceived loudness of the sounds they heard, rather, they told the examiner. This allowed a quick check of communication: regardless of the gaps between the assigned numbers or the numbers themselves, the smallest numbers should apply to the 50 dB tone and the largest to the 98 dB tone, with the others in sequence between. A subject who reports an 62 dB tone as more intense than a 86 dB tone either does not understand the task at hand or is the victim of faulty equipment. We had no problems in this regard.

Subjects then received a seven-page questionnaire with the 139 sensations shown in Appendix 1 listed next to spaces for magnitude matching ratings. Subjects were told that if any of the sounds they had just heard was as intense a sensation as any of those on the list, that listed sensation should receive the same number. The final sensation in each group was designated as the most intense that subject had ever experienced: subjects were asked to name the sensation and provide it with an intensity rating. The experimenter could then pair sensations perceived equally intense. This last step turns the intensity ratings into a magnitude matching experiment.

Subjects were then asked, by the examiner, where, on their numerical scale, sensations that could be described by the following adjectives fell: barely detectable, weak, moderate, strong, very strong, strongest sensation experienced and, again, the possible maximum.

The questionnaire was followed by two more random series of the same five tones. This, again, allowed a check. The ten numbers from these stimuli should have been in sequence and similar to the initial ten tones. They were.

Four series of five tastes and five tones followed. This is a routine experiment in the taste lab and was alluded to above. Subjects first rinsed their mouth with deionized water and then received medicine cups with sodium chloride solutions (0.01 M, 0.032 M, 0.1 M, 0.32 M, 1.0 M). They "sipped, swished and spat" the solutions, rating the intensity of each using the magnitude matching scale they had developed and rinsing their mouths between cups. A random series of the five tones followed. The five salt solutions were then presented a second time, in random order, with the five tones following, also in random order. This two-series test of five tastes and five tones was repeated using PROP solutions (0.000032 M, 0.0001 M, 0.00032 M, 0.001M, 0.0032 M). Subjects who had trouble rinsing a bitter taste from their mouths after the PROP solutions were given cups of dilute saline. They rinsed with deionized water prior to receiving their next taste cup. After the final tone series, subjects were given a disk of filter paper dipped in a saturated PROP solution (1.6 mg PROP per 3 cm disk) and asked to rate the intensity of its taste. We then, when time allowed (49 out of 57 times), used blue food coloring to stain the distal third of our subjects' tongues. We videotaped these using 10x magnification to have a record of fungiform papilla density.

The sequence of the sensations on our questionnaire was chosen to minimize context effects. As strong tastes came toward the end, just as the PROP paper did among the actual taste stimuli, we minimized the higher scores subjects who taste PROP more intensely than others might have assigned later sensations. We also included a broad range within each modality of remembered sensations. This allowed a check akin to that provided by the tone series: for example, we know that a jet engine should sound louder than a ticking watch and the loudness of an everyday conversation should fall somewhere between those two values. As the paired taste-and-tone aspect of the study should

highlight, subjects were able to pair sensations of equal intensity. Several flipped back and forth while completing the questionnaire as they realized a ginger cookie felt as tingly on their tongue as a bee's buzz is loud to their ears.

And then we chose a normalizing standard. Subjects using magnitude matching, by definition, use a range of numbers for the same experience. Clearly, as all that has come before has sought to demonstrate, all experiences, even from the same stimulus, are not the same, but how do we best compare them? First, from the range, the variety of our 139 sensations plus the solutions (PROP, NaCl) and tones; and then from normalization. To normalize data like ours, a standard is chosen, and each subject's data are multiplied by that number which will make the standard sensation equal for all subjects as described earlier. Looking for a standard was especially interesting for these data as two modalities (taste and hearing) appeared linked.

Data Analysis

How to choose the best normalization for these data? We began with our subjects' anatomy: fungiform papillae are not a perfect tool for assessing perceived intensity of oral sensations because they are subject to pathology, but they are a good starting point. As shown above, trauma and disease are among the variables that affect whether and how intensely a signal (a taste stimulus) that lands on a receptor (in this case, a fungiform papilla) is perceived. We began with simple regressions: fungiform papilla counts on the x-axis, perceived bitter of PROP paper (1.6 mg PROP) on the y-axis. How did we scale perceived bitterness? For one normalization, we pooled nonoral sensations and set the greatest value equal to 100; all of a subject's data were multiplied by the value necessary to bring the strongest perceived nonoral sensation to 100. The perceived bitterness of PROP paper was then plotted on the y-axis. A second

normalization set the brightest light seen at 100, and a third set the perceived intensity of 1M NaCl at 100. These plots are shown in the following section (Figures 4a, 4b, 4c). We chose the normalization that best reflected an ideal: more fungiform papillae, more bitter intensity. We chose strongest nonoral sensation as the 100 value for our data analysis. All numbers collected from each of our subjects were then multiplied by a number that set his or her most intense nonoral sensation equal to 100. With each subject's data thus normalized, each value multiplied by the number necessary for his or her strongest nonoral sensation to equal 100, we had a set of normalized data.

With our data normalized, we needed to see which sensations varied with taster status and which did not. Again, we knew that our subject pool would contain nontasters, medium tasters and supertasters. Once we identified them, we needed to insure that they differed, that the perceived intensities of oral stimuli varied as expected. Then we needed to see what was the same, which sensations from our list were, on average, of equal intensity to all our groups. Appendix 3 contains correlation coefficients for all sensations evaluated with data normalized to strongest nonoral sensation. We later ran an analysis of variance (ANOVA) to insure that our simple approach held. It did. Nonoral sensations did not associate with PROP status; taste sensations did associate. Tables with results from these ANOVAs are shown in Appendix 4

As an aside, the regression analysis indicated a link between sound and taste stimuli which is, on the surface, puzzling. It may be due to coincidence; it may be that the common corridor the chorda tympani and acoustic nerves share renders them similarly susceptible to damage.

Results

Normalization and adjective labels

This study is a step forward from those that have examined perceived intensities across subjects. We know fungiform papilla density is not a perfect measure of the bitterness an aspirin can deliver to a tongue, because fungiform papillae, surface receptors, will not reflect the otitis media, upper respiratory tract infections and head trauma that may have affected the neural component of an individual's sense of taste. But fungiform papillae are, nonetheless, the most perfect anatomical tool available. We as yet have no better, no easier receptors to count. Below, three graphs form Figure 4. Each shows the perceived bitterness of a PROP paper disk plotted against the average number of fungiform papillae in a 6 mm circle on either side of the tongue's midline. The plots differ slightly based on different normalizations. In the first graph, the "strongest nonoral sensation experienced" was set at 100 and every other value was multiplied to make this true for all 57 subjects. The second graph has "brightest light experienced" set at 100. The third graph has the intensity of 1.0 M NaCl as 100. The choice of normalization procedure is important as an inappropriate standard would obscure the association between fungiform papillae density and the perceived bitterness of PROP. We know, for example, that NaCl saltiness associates with PROP bitterness (supertasters perceive the most intense saltiness). Normalizing to NaCl thus diminishes the magnitude of the association between fungiform papillae and PROP bitterness. An interesting aspect of the graphs below is the similarity of strongest nonoral sensation experienced and strongest brightness experienced. Strongest brightness is, clearly, a similar and intense experience for many of the subjects in our sample.

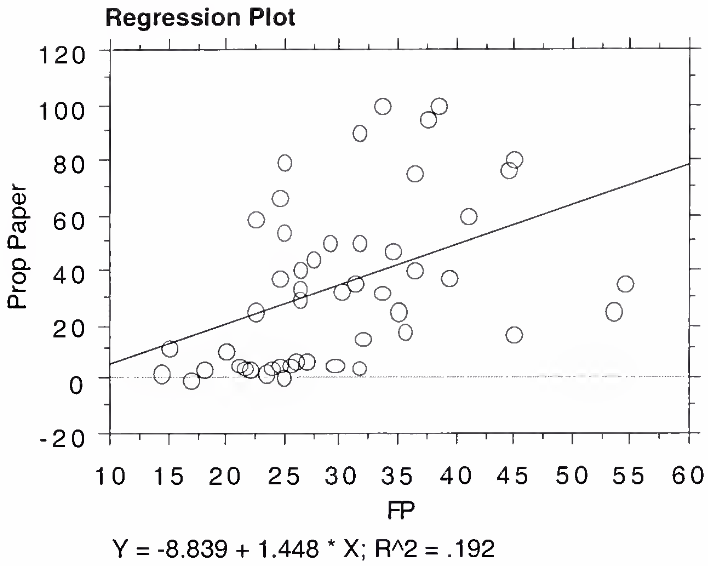


Figure 4a. Above, fungiform papillae count on the x-axis, bitterness of PROP paper on the y-axis. Numerical value for bitterness based on normalization to strongest nonoral sensation = 100.
P-value for above is 0.0016.

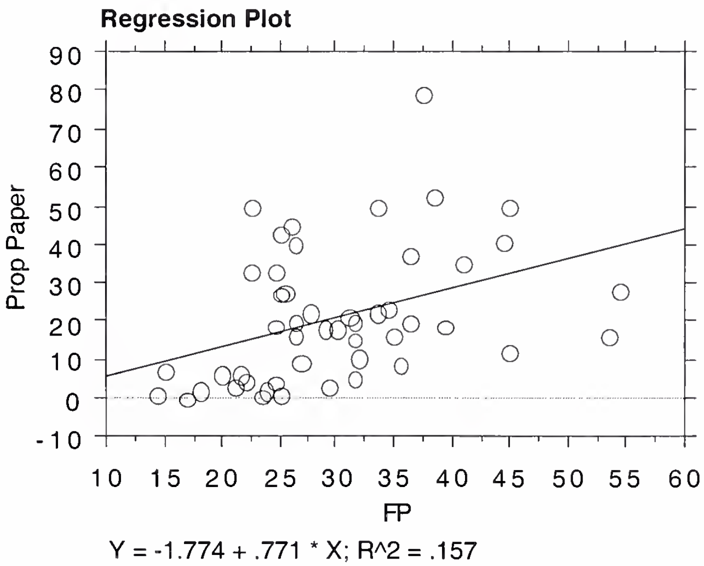


Figure 4b. Above, fungiform papillae count on the x-axis, bitterness of PROP paper on the y-axis. Numerical value for bitterness based on normalization to strongest brightness experienced = 100. P-value for above is 0.0049.

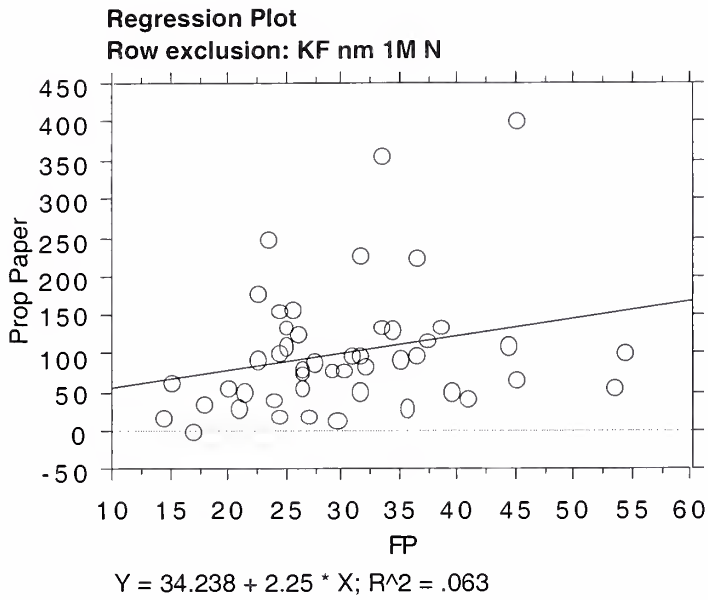


Figure 4c. Above, fungiform papillae count on the x-axis, bitterness of PROP paper on the y-axis. Numerical value for bitterness based on normalization to 1 M NaCl = 100. P-value for above is 0.0886.

Once we have a normalization procedure consonant with anatomy, we are best served by using perceived intensity of bitter stimuli to evaluate taste sensations. Anatomy, as discussed above, is only the surface. Trauma and disease affect how well fungiform papillae function, and perceived intensity of a PROP solution accounts for both anatomy and pathology. As noted in the discussion of the three graphs above, choosing a salt solution as a normalizing standard is not very useful when we know we are dealing with groups for whom that is not a standard experience. We expected taste sensations to be similar within each group and to differ among them.

We chose the normalization shown in the first graph above to separate our groups of tasters. Any of several selection criteria would provide us with the same three groups. As we had 57 subjects, we could have assumed our sample reflected the wider world—the recognized distribution of nontasters, medium tasters and supertasters. Doing this would have meant looking at perceived intensity of PROP bitterness and designating the top

25% of values as those of supertasters and the bottom 25% as belonging to nontasters. We could have chosen numerical cut-offs, or looked at our subjects' numerical values for "barely detectable," "weak," "moderate," "strong" and "very strong." The methods were equivalent; we separated our pool into 14 nontasters who had normalized PROP paper bitterness ratings less than 6 and 15 supertasters with normalized PROP paper bitterness intensities greater than 50. Medium tasters were those 28 subjects who fell between. Using our adjectives also meant we could compare the numerical values our subjects gave them with those Green assigned the adjectives of his LMS. Figure 5, below, demonstrates that "low intensity" adjectives such as "barely detectable" and "weak" were spaced, on a 0-to-100 ruler, more or less as Green's were. But there are clear differences as well, especially as intensities increase toward the ever-elusive best top of a scale.

Figure 5 highlights a weakness of numerical scales: units and numbers are less important than the ratios between them. The ratio of the spaces between "barely detectable" and "weak," "strong" and "very strong" and so forth is what matters, not the numbers attached. Future experiments may demonstrate that even properly spaced adjectives are less meaningful than common sensations. The experiment undertaken for this thesis provided data that not only allowed us to see the ratios among everyday sensations within our subject pool but also allowed us to narrow those common sensations to the ones most meaningful across different groups of people.

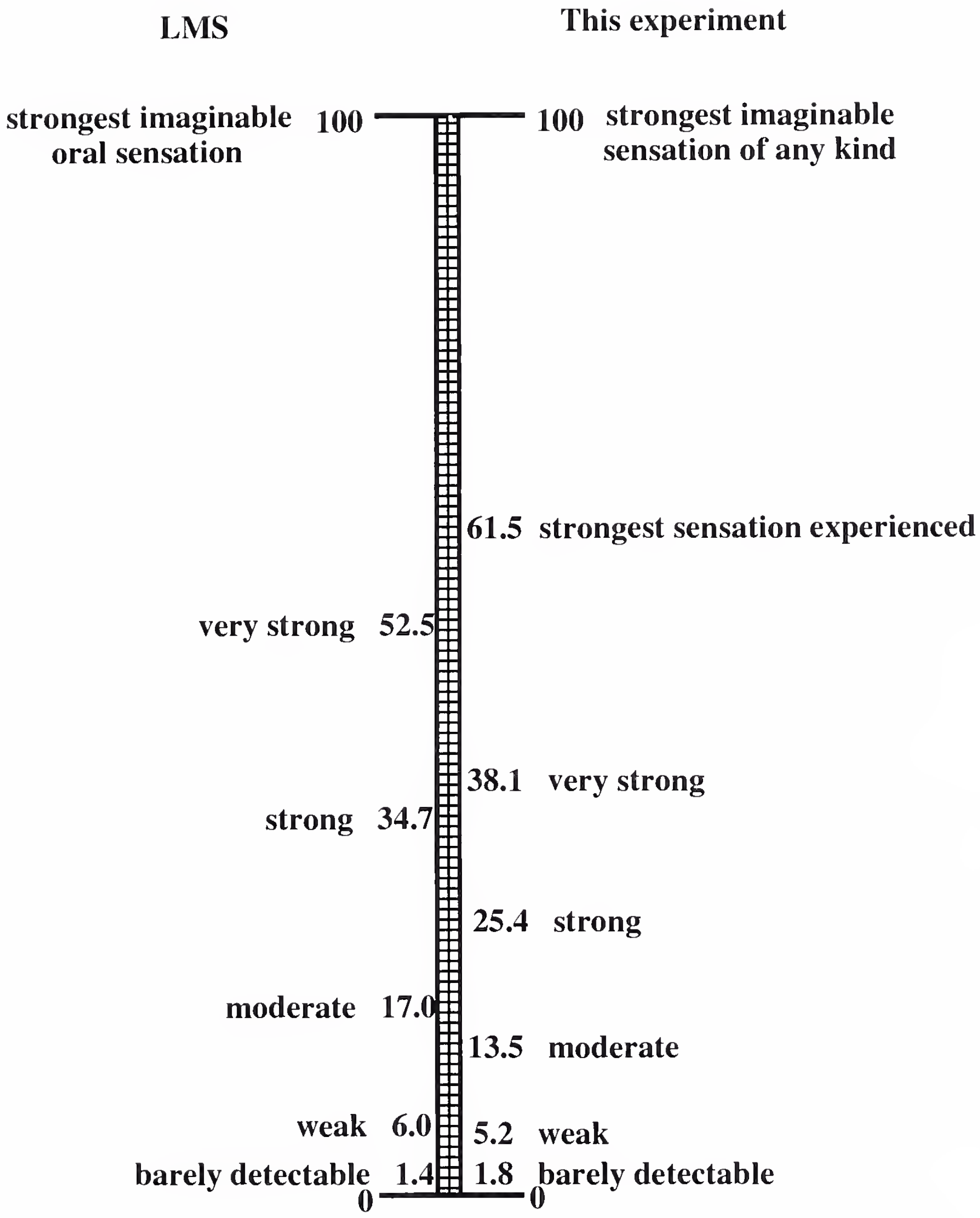


Figure 5. Above is a 100-point ruler with the adjectives scaled by Green (LMS) on the left and those from the current experiment on the right. Note that including "strongest sensation experienced" in the current investigation appears to have "pushed down" adjectives of lesser intensity.

Non-oral sensations and taste sensations

Insuring that what should differ (the perceived intensity of oral stimuli) does differ means we can then examine other sensations. Below, in Figure 6, are two sets of bar graphs. The first demonstrates the average intensities of nonoral sensations which did not vary among our taster groups. The second shows the varied intensity perceived by both nontasters and supertasters from oral stimuli. Figure 7, which follows, is a ruler labeled with sensations common to all. Perhaps, someday, it will have a clinical use, be it for analgesic or sedative, beta-agonist or cardiac glycoside dosage.

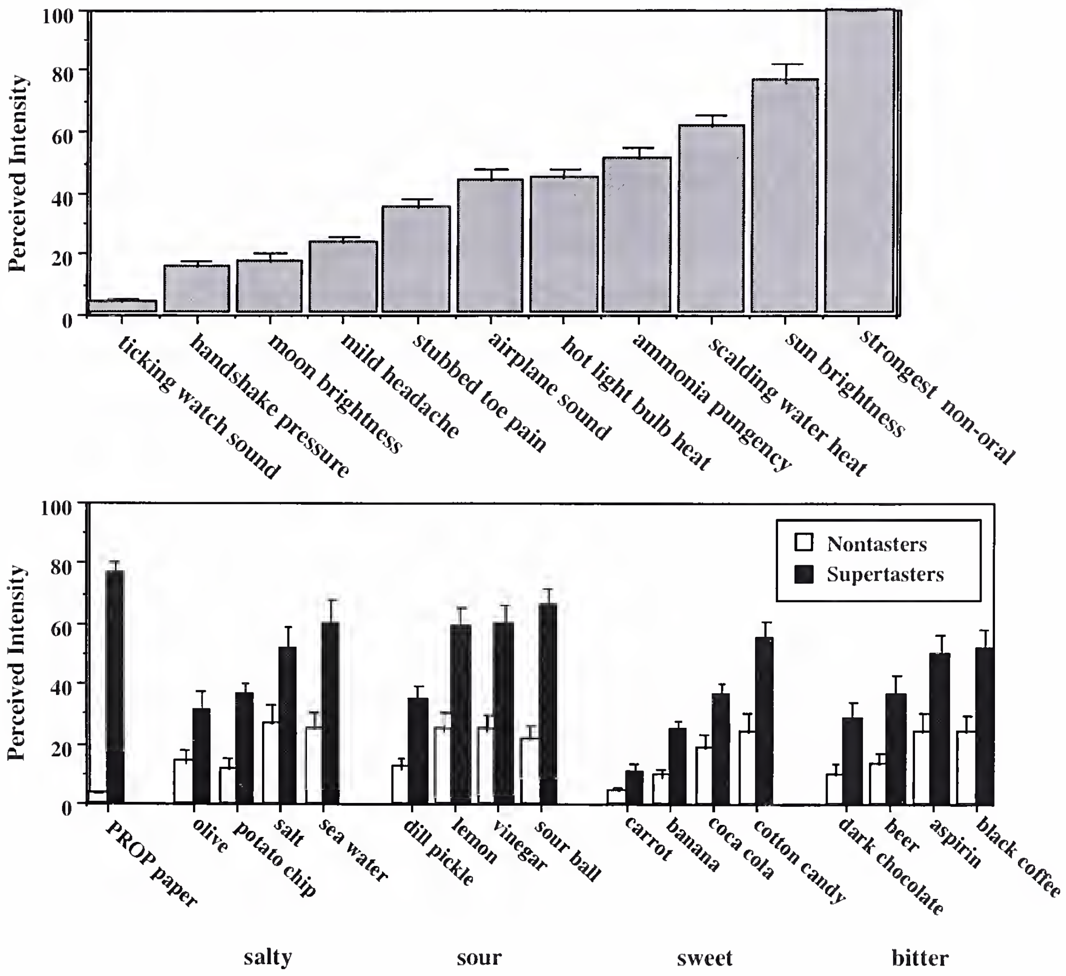


Figure 6. Above, two bar graphs. The top shows the average intensities (± SE) for ten nonoral sensations. The average intensities of these sensations did not difffer among PROP groups. The graph below shows the four taste stimuli (± SE).

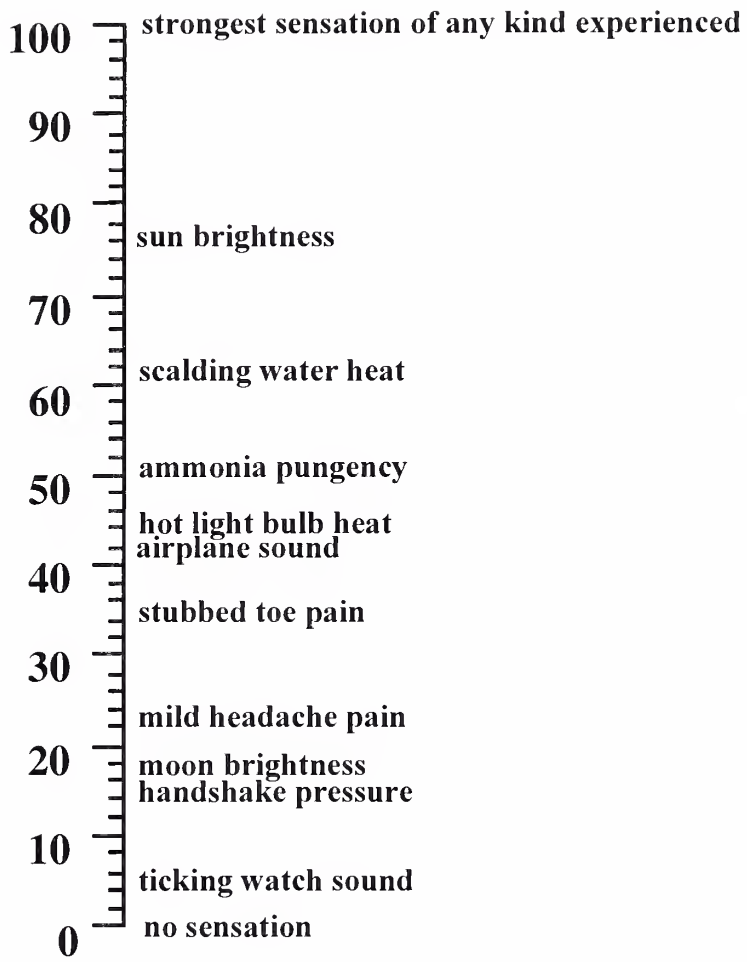


Figure 7. The ten sensations shown in the top graph of Figure 6 shown as a ruler. These sensations are similarly intense to all. A copy of the above could be presented to a patient to evaluate symptom severity. Is the tightness an asthmatic may feel in her chest as severe as an airplane is loud? Does this correlate with the dosage of medicine that brings her relief?

Discussion

Now what? Now we know that pain, pressure, visual and thermal stimuli are similar across people. Does this mean that it is fair to ask a patient if his knee is as sore as a sourball candy is tart? If his knee is as sore as the moon is bright? Is this a step toward diagnosis? Yes and no.

No because, without context, there is no way to know a patient's taster status (although, if that knee is sore secondary to a sports injury, one might want to assume head trauma may be in the mix). Yes because anytime a patient can match sensations, his or her physician learns more about the patient's sensory world and can make better sense of the patient's story. If a knee is as sore as a candy is tart, one should find out what is as luminous as that candy is sour. What is as warm? What is as cold? *That* is meaningful data. This approach, if applied to large numbers of people with a range of diagnoses, could produce information we can now only imagine. What if obese teens after an hourlong fast are as hungry as their normal weight peers after a ten-hour fast? What if the perceived "heat" of a menopausal hot flash correlated with response to treatment? What if we could gauge grief over time to better identify those at risk for depression after the death of a spouse? We could save time. We could save money. We could save pain and suffering.

How do we get there? Now that we have a solid approach, we need to expand it in the two most obvious ways. With the assay of more sensations and the discovery of more groups, we will find more differences and more that is common, and this is a step toward as yet unknowable applications. Later data than those discussed here, drawn from a similar questionnaire (less extensive and allowing more people to complete the task

in a lecture format), showed sex effects in pain. This is to say that, for pain, there are at least two groups with different ranges of experience. Women and men enter adulthood with similar ranges of pain experience. Childbirth changes this. Women who select childbirth as their most intense pain experience denote it as 25% more intense than the most intense pain experience to men. What if we were to add military veterans to our subject pool? Combat injuries among men might mimic or even surpass the experiences of childbearing for women. We live in an age when some women have experienced both battlefield trauma and delivery without anesthesia. We might be able to identify certain sorts of injuries that are, on average, as intensely painful as childbirth. This would be helpful not only for the insight into human experience it would provide, but also because the "you'll only feel a pinch" and "this won't hurt a bit" chorus patients hear could be modified. Modified in a way that might build trust between clinicians and those they care for. Preparing someone for a procedure by saying: "This is probably going to be about a fifth as painful as your knife wound and about a tenth as painful as your knee surgery was" might be advantageous. It seems difficult to imagine steps like these, but Queen Victoria's ether was not that long ago in terms of medical progress. And who, even thirty years ago, would have imagined that two sisters could have the same blood test and one end up guided toward and the other away from prophylactic mastectomies?

What are the sensations we need to ask about and what are the groups we may find? The perspective gained from undertaking this experiment has led, as noted above, to other experiments. One involved the measurement of itch. The results of this study are as yet unpublished, and the number of subjects was small, but there were individuals evaluated in whom peripherally iontophoresed histamine did not induce itch. These

individuals have a knowledge of itch and scratching based almost wholly on what they have observed in the world around them and they appear otherwise indistinguishable from their siblings, classmates and colleagues. Now that this group has been identified, there is a clear clinical application: should such patients present to their physician with itch, the likelihood that the cause is peripheral is small. A jump right to evaluations for metabolic, central and paraneoplastic itch is likely indicated. Lives might be saved.

We didn't include itch stimuli on our original questionnaire It would be of interest to do so. Most children know some of their peers are ticklish and some are not: the world is simply thus. Building on the experiment described in this thesis means adding sensations like itch, like dyspnea, like satiety, like tickle and even anxiety, jealousy and despair.

Summary

We have made progress toward constructing a scale that will allow comparisons of experiences across groups and people. Though we still have much ground to cover, we have learned much so far that surprised us. We did not expect "strongest brightness experienced" to be such a reliable sensory ceiling. As "strongest brightness experienced" was usually equal to the scaled brightness of the sun, we may have stumbled across a new shorthand for sensory measurement: how intense is a sensation when compared with the brightness of the sun? An experiment with stimuli compared to perceived brightness of the sun should even allow us to work in reverse, to separate subjects by taster status as well, as a given bitter solution may seem 1/2 as intense as the sun is bright to those with the greatest fungiform papilla density, and 1/20 as intense to those with the fewest

fungiform papilla. The mean-density subjects would fall somewhere in between.

The more we learn about the consistencies and differences among the scales used by each of us to integrate the sensory experiences of our lives, the more likely we will be to not only synthesize a scale that can be used to evaluate those sensory experiences for real-world applications and real-world aid but also to put it to use.

References

1. Bartoshuk, L.M., Sweetness: History, preference, and genetic variability. Food Technology, 1991. 45: p. 108-113.
2. Bartoshuk, L.M., The biological basis of food perception and acceptance. Food Quality and Preference, 1993. 4: p. 21-32.
3. Bartoshuk, L.M., ed. Genetic and pathological taste variation: What can we learn from animal models and human disease? The Molecular Basis of Smell and Taste Transduction, ed. D. Chadwick, J. Marsh, and J. Goode. Vol. Ciba Foundation Symposium 179. 1993, John Wiley and Sons: New York. 251-267.
4. Bartoshuk, L.M., V.B. Duffy, L. Etter, K. Fast, V. Garvin, L.A. Lucchina, J. Rodin, D.J. Snyder, R. Striegel-Moore, and H. Wolf, Variability in taste, oral pain, and taste anatomy: Evidence for menstrual control over oral perception. Appetite, 1997. 29: p. 388.
5. Bartoshuk, L.M., V.B. Duffy, and I.J. Miller, PTC/PROP tasting: Anatomy, psychophysics, and sex effects. Physiology and Behavior, 1994. 56: p. 1165-1171.
6. Bartoshuk, L.M., V.B. Duffy, D. Reed, and A. Williams, Supertasting, earaches, and head injury: Genetics and pathology alter our taste worlds. Neuroscience and Biobehavioral Reviews, 1996. 20: p. 79-87.
7. Blakeslee, A.F., Genetics of sensory thresholds: Taste for phenyl thio carbamide. Proceedings of the National Academy of Sciences, 1932. 18: p. 120-130.
8. Blakeslee, A.F. and A.L. Fox, Our different taste worlds. Journal of Heredity, 1932. 23: p. 97-107.
9. Blakeslee, A.F. and T.N. Salmon, Genetics of sensory thresholds: Individual taste reactions for different substances. Proceedings of the National Academy of Sciences, 1935. 21: p. 84-90.
10. Borg, G., A category scale with ratio properties for intermodal and interindividual comparisons, in Psychophysical Judgment and the Process of Perception, H.G. Geissler and P. Petzold, Editors. 1982, VEB Deutscher Verlag der Wissenschaften: Berlin. p. 25-34.
11. Duffy, V.B., L.M. Bartoshuk, L.A. Lucchina, D.J. Snyder, and A. Tym, Supertasters of PROP (6-n-propylthiouracil) rate the highest creaminess to high-fat milk products. Chemical Senses, 1996. 21: p. 598.
12. Fast, K., V.B. Duffy, and L.M. Bartoshuk, New psychophysical insights in evaluating genetic variation in taste, in Olfaction, Taste, and Cognition, C. Rouby, et al., Editors. 2002, Cambridge University Press: Cambridge, U.K. p. 391-407.
13. Fechner, G.T., Elemente der Psychophysik. 1860, Leipzig: Breitkopf and Härterl.
14. Fernberger, S.W., A preliminary study of taste deficiency. American Journal of Psychology, 1932. 44: p. 322-326.
15. Fox, A.L., Six in ten "tasteblind" to bitter chemical. Science News Letter, 1931. 9: p. 249.
16. Glanville, E.V. and A.R. Kaplan, Taste perception and the menstrual cycle. Nature, 1965. 206: p. 930-931.

17. Green, B.G., P. Dalton, B. Cowart, K. Rankin, and J. Higgins, Evaluating the labeled magnitude scale for measuring sensations of taste and smell. Chemical Senses, 1996. 21: p. 323-334.
18. Green, B.G., G.S. Shaffer, and M.M. Gilmore, A semantically-labeled magnitude scale of oral sensation with apparent ratio properties. Chemical Senses, 1993. 18: p. 683-702.
19. Marks, L.E., The slippery context effect in psychophysics: Intensive, extensive, and qualitative continua. Perception & Psychophysics, 1992. 51: p. 187-198.
20. Marks, L.E., J.C. Stevens, L.M. Bartoshuk, J.G. Gent, B. Rifkin, and V.K. Stone, Magnitude matching: The measurement of taste and smell. Chemical Senses, 1988. 13: p. 63-87.
21. Miller, I.J. and F.E. Reedy, Variations in human taste bud density and taste intensity pereeption. Physiology and Behavior, 1990. 47: p. 1213-1219.
22. Prutkin, J.M., K. Fast, L.A. Lucchina, D.J. Snyder, and L.M. Bartoshuk, Spatial taste testing and genetic taste variation. Chemical Senses, 1999. 24: p. 604.
23. Silver, W.L. and T.E. Finger, The trigeminal system, in Smell and Taste in Health and Disease, T.V. Getchell, et al., Editors. 1991, Raven Press: New York. p. 97-108.
24. Solomon, G.M., F. Catalanotto, A. Scott, and L.M. Bartoshuk, Patterns of taste loss in clinic patients with histories of head trauma, nasal symptoms, or upper respiratory infection. Yale Journal of Biology and Medicine, 1991. 64: p. 280.
25. Stevens, S.S., On the psychophysical law. Psych Rev, 1957. 64: p. 153-181.
26. Stevens, S.S., Sensory scales of taste intensity. Perception and Psychophysics, 1969. 6: p. 302-308.
27. Tepper, B.J. and R.J. Nurse, Fat perception is related to PROP taster status. Physiology and Behavior, 1997. 61: p. 949-954.
28. Whitehead, M.C., C.S. Beeman, and B.A. Kinsella, Distribution of taste and general sensory nerve endings in fungiform papillae of the hamster. American Journal of Anatomy, 1985. 173: p. 185-201.

Appendix 1

List of 139 sensory experiences rated by subjects.

Appendix 1 - Questionnaire Sensations

Loudness
bee's buzz
car alarm
car door slamming
conversation
fire engine going by in the street
ticking watch
whisper
airplane flying nearby
glass breaking
strongest sound experienced

Brightness
car's turn signal during the day
indoor fluorescent lighting
oncoming car headlights--low beam--at night
oncoming car headlights--high beam--at night
outside Christmas lights at night
moon at night
sun
amber traffic light
green traffic ligh
red traffic light
strongest brightness experienced

Pressure
friendly slap on the back
affectionate pat on the cheek
average handshake
turning on a light switch
strongest pressure experienced

Pain
broken bone
mild headache
severe headache
stubbed toe
childbirth contractions near delivery
passing a kidney stone
shock from an electrical appliance
strongest pain experienced

Odor
lemon
rose
skunk
bacon frying
bread baking
lilacs
turkey roasting
vanilla
cocoa
warm apple cider
strongest smell experienced

Nasal pungency
sniffing mothballs
sniffing ammonia
strongest nasal pungency experienced

Thermal sensations/warmth or heat
touching a hot pan
warmth of a cat sitting in your lap
heating pad
hot bath
touching an oven door
briefly touching a hot light bulb
dipping your hand in scalding hot water
sun on your face on a spring day
washing your hands in warm water
walking barefoot on hot pavement
warmth/heat of sunburn on your face
strongest heat experienced

Thermal sensations/coolness or cold
cool washcloth against your forehead
soda can held in your hand
briefly touching an ice cube
holding an ice cube in your hand
picking up snow with bare hands
taking a cool shower on a hot day
walking barefoot on cold floor tiles
washing your hands in cold tap water
touching room-temperature silverware
strongest cold experienced

Flavor perceived when substance is in your mouth

chocolate flavor of a Hershey bar
peanut flavor of peanut butter
vanilla flavor of pudding
strawberry flavor of jam
strongest flavor experienced).

Taste/saltiness
potato chip
pretzel
salt crystals
sea water
soup broth
olive
strongest salt experienced).

Taste/sourness
dill pickle
lemon
sourdough bread
vinegar
sour ball candy
strongest sour experienced

Taste/sweetness
banana
cherry lifesaver
Coke
red apple
cotton candy
Hershey bar
honey
sugar crystals
carrot
strongest sweet experienced

Taste/bitterness
black coffee
celery
dark chocolate
beer
aspirin
grapefruit juice
strongest bitter experienced

Oral burn/from everyday oral things
mint toothpaste

cinnamon gum
jalapeno peppers
medium salsa
hot salsa
yellow mustard
carbonation of a cola drink
ginger cookie
strongest oral burn experienced

Oral pain/from damage or pathology
biting your tongue
toothache
canker sore--apthous ulcer
strongest oral pain experienced

Oral warmth or heat
sipping a cup of hot tea or coffee
warm bread in your mouth
burning your mouth on hot pizza
strongest oral heat experienced

Oral coolness or cold
holding an ice cube in your mouth
touching your tongue to ice
sipping room temperature water
strongest oral cold experienced).

Floral odors/substance sniffed
violet
lilac
rose
strongest floral odor experienced

Fruit odors/substance sniffed
orange
banana
pear
strongest fruit odor experienced

Sweetness of beverages
sweetness of lemonade
sweetness of commercial sweetened ice tea
sweetness of Pepsi
strongest sweetness of a beverage experienced

Strongest sensation experienced (specify)
Strongest sensation that you could realistically experience if the right situation occurred (specify number).

Appendix 2

Raw Data

Subject #	Date tested	Age	DOB	Sex	Height (in)	Weight (lbs)	Race	Children	Lose Taste	Dysgeusia	Head Trauma	Otitis Media	1dB_98	1dB_86	1dB_74	1dB_62	1dB_50	2dB_98	2dB_86	2dB_74	2dB_62	2dB_50
1	08/15/01	24	02/27/77	2	72.5	187	3	0	1	1	1	3	8	8	4	2	2	14	10	3	2	1
2	08/07/01	24	10/14/76	1	67	120	3	0	3	1	1	3	14	9	3	5	1	17	11	4	2	0.5
3	08/07/01	19	08/22/81	1	59	140	2	0	3	1	1	1	6	2	2	1	0.5	6	6	2	0.5	0.5
4	07/26/01	36	02/06/65	1	64.75	115	3	0	3	2	3	4	5	3	2	3	1.5	6.5	4	1.5	1	0.5
5	08/13/01	25	03/07/76	2	70	187	3	0	2	1	1	2	12	5	3	2	1	12	4	4	2	0.5
6	08/16/01	44	09/14/56	2	73	230	3	2	1	1	1	1	9	5	2	1.5	1	10	5	2	1	1
7	07/31/07	26	12/13/75	1	66.5	120	3	0	1	1	1	1	30	20	13	10	5	25	17	13	9	5
8	07/01/01	49	01/04/52	2	74	215	3	2	2	4	3	1	6	4	3	1	1	8	4	2	1	1
9	08/08/01	49	04/04/52	1	62	185	4	2	3	3	1	2	20	12	6	8	3	24	20	6	8	2
10	08/24/01	25	12/29/75	2	70	155	3	0	2	1	1	1	6	4	3	2	1	5	3	2	1	1
11	08/09/01	27	09/29/73	2	70	210	3	2	1	1.5	1	1	10	6	5	3	1.5	10	6	5	2	1
12	07/27/01	21	06/04/80	2	71	165	2	0	1	1	1	2	15	10	5	5	3	20	8	6	3	2
13	08/03/01	20	12/07/80	1	64	145	2	0	3	2	2	3	2	1	0.75	0.5	0.5	3	2	1	0.75	0.5
14	08/03/01	26	05/08/75	2	67	165	3	0	1	2	2	1	6	4	1.7	1.7	2	5	5	1.7	2	1.4
15	08/06/01	29	07/26/72	2	73	175	3	0	2	1	1	1	9	7	2.5	3	2	7	4	3	2	2.5
16	08/23/01	23	06/03/78	1	65	108	3	0	3	1	1	3	20	8	5	4	2	20	10	5	4	2
17	07/20/01	19	12/28/81	1	63.5	135	3	0	3	1	1	1	8	5	4	1	0.5	8	6	3	0.125	0.25
18	08/03/01	23	09/21/77	2	76	175	3	0	1	1	1	1	3	2	1	0.4	0.5	4	2	1	0.5	0.4
19	08/22/01	22	06/18/79	2	67	145	1	0	2	1	1	2	60	50	15	10	5	75	60	25	10	5
20	07/30/01	43	09/19/57	2	67	170	3	4	4	2	1	1	45	30	15	15	10	45	20	8	6	7
21	08/10/01	25	08/01/76	1	68	127	3	0	2	1	1	2.5	18	6	4	3	2	21	8	4	2	1
22	08/07/01	25	03/06/76	2	72	175	3	0	3	1	4	1	16	8	4	2	2	24	8	4	2	2
23	07/30/01	26	01/15/75	1	67	160	3	0	1	2	1	1	10	8	5	4	3	10	6	5	2.5	2.5
24	08/24/01	22	10/19/78	1	61.5	125	5	0	2	1	1	4	40	10	5	2	2	60	20	10	1	1
25	08/21/01	24	08/22/76	2	69	175	3	0	3	1	3	3	10	5	4	3	2.5	20	10	5	4	2.5
26	08/21/01	25	11/03/75	2	69.5	155	3	0	1	1	1	2	15	10	5	3	2	19	9	3	2	1
27	07/25/01	31	12/20/69	2	72	167	3	0	3	1	1	1	6	3	1	0.75	0.5	5	3	1	0.7	0.5
28	08/17/01	26	11/08/74	2	73	190	3	0	2	1	1	1	10	7	5	3	2	15	7	5	3	2
29	07/20/01	22	08/05/78	1	64	130	3	0	1	1	1	3	50	25	18	10	5	80	40	22	11	6
30	08/10/01	21	03/19/80	1	67	120	1	0	3	1	1	2	20	10	7	5	3	20	15	5	2	1
31	08/23/01	30	09/26/70	1	66	165	3	0	2	1	1	1	8	4	2	1	1	8	4	2	1	1
32	08/21/01	24	03/06/77	1	67	120	3	0	2	1	1	1	8	4	1	0.5	2	6	2	0.5	0.25	0.125
33	07/26/01	43	03/20/58	1	61	150	3	2	2	1	1	2	4	2	1	1	0.5	4	3	2	0.5	0.25
34	08/10/01	21	07/14/80	1	66	190	2	0	3	1	1	1	8	4	2	2	1	12	8	4	2	1
35	08/01/01	23	09/01/77	1	63	120	5	0	1	1	1	3	100	70	50	30	30	110	70	40	30	25
36	08/21/01	26	05/01/75	1	64	140	3	0	3	1	1	3	6	3	2.5	4	2	8	6	2.5	2	1
37	08/16/01	24	08/13/77	2	67	220	4	0	3	1	2	1	8	5.5	4	1.5	1	9	4	3	1.5	1
38	07/26/01	32	04/28/69	1	62	122	4	0	4	1	1	1	10	7.5	4	5	2.5	12	8	5	3	1
39	08/17/01	18	03/11/73	2	65.5	125	5	0	1	1	1	2	20	10	3	5	1	20	10	5	3	0.5
40	07/30/01	24	06/22/77	2	72	175	3	0	2	1	1	2	55	30	10	10	5	50	25	10	5	2.5
41	08/02/01	20	02/17/81	1	61	130	3	0	3	2	1	3	5	6	4	2	2	7.5	7	3	2	2
42	07/27/01	30	09/05/70	1	62	114	5	0	3	1	1	1	8	5	4	2	1	8	5	2	0.5	0.5
43	08/08/01	21	01/30/80	2	67	160	4	0	2	3	1	1	6	3	2	1	1.5	9	3	1	1	0.5
44	07/28/01	24	05/23/77	1	67	125	3	0	3	1	1	1	6	4	2	2	1	8	2	2	1	0.5
45	08/20/01	24	04/22/77	2	71	158	3	0	3	1	1	1	30	20	10	10	5	30	20	10	5	5
46	08/16/01	27	07/17/74	1	64	135	3	0	3	2	1	4	6	3	3	1.5	1	6	3	2	1.5	1
47	07/26/01	22	10/28/78	1	70	132	3	0	1	1	3	3	50	20	15	10	5	35	25	15	8	5
48	08/06/01	24	02/19/77	1	62	120	3	0	2	1	2	1	50	30	10	10	6	50	20	9	7	3
49	08/15/01	23	06/06/78	2	70	165	3	0	3	1	1	3	6	4	2	2	1	7	5	2	1	1
50	07/25/01	23	03/12/78	2	67	140	3	0	3	1	1	1	8	4	2	2	1	12	4	3	2	0.5
51	07/31/01	18	06/06/83	1	61	125	3	0	1	1	1	3	20	10	5	5	2	15	8	4	4	2
52	08/15/01	30	03/13/71	2	73	300	3	2	2	1	1	1	10	5	3	2.5	2	10	5	2.5	1	2
53	07/25/01	23	05/02/78	2	74	170	3	0	1	1	1	1	10	7	5	2.5	1.25	12.5	8	3.5	3	3
54	08/07/01	23	03/02/78	2	71	200	3	0	3	1	1	1	24	12	6	3	2	35	20	6	3	2
55	08/15/01	25	12/27/75	1	67	125	3	0	2	1	1	2	15	10	4	5	2.5	20	10	7	5	2.5
56	08/09/01	20	11/12/80	1	64	105	6	0	1	1	1	1	15	10	25	2	1	17	7	2	0.5	0.5
57	08/17/01	21	03/09/80	2	67	153	1	0	1	1	1	1	50	25	10	5	3	60	40	6	5	2

Subject #	Sound/bee	Sound/car alarm	Sound/car door	Sound/conversation	Sound/fire engine	Sound/watch	Sound/whisper	Sound/airplane	Sound/glass breaking	#Sound/strongest	Bright/car turn	Bright/indoor fluor lt	Bright/low beam/night
1	1	14	10	6	28	4	1	28	6	30	4	10	8
2	3	25	10	7	30	1	3	10	9	30	5	7	10
3	0.5	4	2	1	6	0.5	0.5	12	3	12	1	2	4
4	1	7	5	4	14	0.5	1.5	6	5	21	1.5	4.5	2
5	2	30	25	7	35	0.2	1.5	70	28	90	4	8	25
6	1	3	4	2	5	0.5	1	3	4	10	1	3	4
7	12	40	30	13	50	7	5	20	30	55	15	25	35
8	1	6	5	3	8	1	2	8	6	12	1	7	5
9	2	30	15	15	50	6	0.5	80	12	100	4	10	10
10	1	6	4	3	7	0.25	1	2	4	8	2	2	4
11	10	80	40	20	90	4	8	70	30	90	40	60	70
12	5	20	20	10	35	5	5	35	15	40	10	20	20
13	0.5	9	3	2	18	0.5	0.25	12	6	30	1	2	3
14	3	9	8.5	7	9.5	2	2	7	7	10	2	3	4
15	1	70	40	40	200	2	5	150	50	200	15	30	100
16	4	18	18	15	20	4	8	10	15	30	15	15	18
17	0.125	100	15	5	110	0.25	0.5	6	3	200	1	30	30
18	0.25	3	3	1.25	6	0.1	0.3	7	2	9	1	1	2
19	10	40	30	25	50	5	5	70	60	85	10	50	60
20	10	30	25	20	50	7	7	45	20	70	5	35	30
21	3	30	21	18	42	2	9	12	15	48	6	12	18
22	3	25	10	10	35	2	3	25	20	50	3	10	10
23	5	12	10	8	13	2	3	14	12	18	3	6	8
24	0.1	70	30	10	80	0.5	2	30	30	100	30	10	20
25	5	30	15	10	50	2	3	40	25	60	5	10	20
26	4	40	9	17	42	2	4	55	35	60	7	27	19
27	0.4	12	9	4	13	0.5	0.3	4	11	16	3	4	7
28	6	12	10	8	15	4	5	15	7	15	3	6	8
29	2	30	15	10	35	1	6	20	30	45	8	10	12
30	7	20	10	10	60	2	5	10	15	65	5	30	40
31	1	8	4	2	8	1	1	8	4	16	1	2	8
32	2	6	3	2	8	0.5	0.5	4	3	12	2	4	4
33	2	200	80	20	300	1	2	50	4	300	1	30	50
34	2	18	12	6	40	3	2	36	10	80	4	20	30
35	25	100	40	40	150	15	15	30	30	135	30	40	45
36	4	40	15	10	50	2	5	20	10	50	5	20	20
37	0.5	14.5	3.5	3	17	0.25	1.5	17	3.5	24	1	2.5	6
38	5	20	50	15	40	10	5	100	30	100	5	50	25
39	1	20	15	10	40	3	3	20	15	80	3	5	15
40	6	60	40	30	120	1.5	7.5	180	50	240	7.5	30	45
41	1	•	2	3	4	1	2	4	4	20	1	5	2
42	4	40	20	10	60	6	2	80	20	80	2	20	40
43	1.5	18	12	6	36	0.5	1.5	36	24	72	3	9	6
44	0.5	6	4	2	8	0.5	1	4	8	8	2	0.5	0.5
45	30	70	10	20	100	5	10	200	150	200	5	15	50
46	1.5	8	6	4	16	0.5	1	3	6	20	3	5	6
47	8	50	20	25	35	12	10	60	20	60	15	28	20
48	3	70	30	10	90	3	5	30	15	90	10	20	30
49	1.5	12	5	3	20	1	1	20	9	30	0.75	10	10
50	5	15	9	3	18	0.5	1.5	18	10	25	1	10	5
51	1	10	8	7	15	4	4	15	10	40	5	10	10
52	2	36	16	12	60	2	4	48	24	84	4	12	16
53	3	15	10	6.5	12	1	1	2	7	36	3	1.5	5
54	6	45	25	15	35	1	2	45	25	75	10	30	35
55	7	20	10	7	35	2	5	20	15	75	7	10	12
56	1	16	10	9	15	0.5	0.5	11	9	19	5	7	5
57	2	50	30	15	100	1	3	75	40	200	10	20	50

Subject #	Bright/high beam/night	Bright/Xmas light	Bright/moon	Bright/sun	Bright/amber traff lt	Bright/green traff lt	Bright/red traff lt	#Bright/stongest	Press/slap/friendly	Press/pat/cheek/affectionate	Press/handshake
1	12	6	4	100	10	8	12	100	8	14	8
2	15	7	5	30	6	7	8	30	5	3	6
3	6	4	6	12	3	4	4	12	3	2	3
4	5	3.5	1.5	10	2.5	2	2.5	15	4	2	205
5	60	20	7	90 •		5	7	90	15	7	12
6	6	3	2	8	3	3	3	10	3	1	2
7	50	15	20	70	15	20	20	70	40	25	30
8	8	3	2	10	1	2	1	12	3	1	4
9	20	7	5	24	12	10	8	80	12	4	12
10	5	1	2	8	2	3	2	9	4	3	3
11	85	55	50	90	35	35	40	90	5	2.5	10
12	30	15	30	40	10	10	10	40	8	5	10
13	5	1	1	3	1.75	2	1.5	12	1	0.5	2
14	6	4	5	10	5	5	5	10	4	2	3.5
15	150	2	10	150	10	10	15	200	50	10	25
16	30	15	15	35	10	15	15	35	15	8	15
17	60	10	5	200	5	5	5	200	6	3	3
18	4	1.5	1.5	20	1.5	1.5	1.5	20	2	1	2
19	70	25	20	80	25	20	25	80	30	15	35
20	45	4	10	50	8	9	7	70	10	5	5
21	48	9	24	90	8	10	12	120	8	2	6
22	25	10	15	50	3	3	3	50	10	5	10
23	10	4	4	20	5	6	7	20	7	4	5
24	35	12	7	90	20	20	25	95	5	5	10
25	35	10	15	60	15	15	15	60	10	6	4
26	37	8	6	50	5	9	9	50	10	10	6
27	9	5	4	17	4.5	4	5	18	4	6	5
28	10	7	10	15	6	6	6	15	5	4	7
29	30	6	2	20	12	15	12	35	10	6	8
30	50	10	10	60	20	20	20	60	10	5	7
31	16	1	2	4	1	1	1	32	4	1	4
32	6	4	4	6	2	2	2	14	4	2	2
33	160	8	8	200	2	2	2	300	3	2	3
34	50	28	60	80	28	27	26	80	6	2	8
35	60	20	20	100	20	25	20	150	40	55	40
36	30	10	10	100	18	15	14	100	10	5	10
37	15	6	4	30	3	2.5	4	30	2	5	3.5
38	60	60	25	100	35	10	30	100	5	2.5	10
39	30	10	3	15	5	5	5	40	10	5	15
40	90	20	20	180	15	15	15	180	30	10	25
41	6	4	3	12	4	2	2	12	2	1	1
42	60	20	10	40	10	10	20	40	8	4	4
43	18	9	12	48	6	6	6	88	12	6	6
44	1	1	0.5	2	4	2	4	8	4	4	2
45	80	15	10	300 •		30	50	300	20	40	30
46	12	3	5	20	3	3	5	20	5	3	5
47	35	15	20	50	12	15	12	60	20	15	25
48	30	20	15	80	10	15	20	80	20	10	5
49	15	1.25	2.5	20	2.5	1.25	2.5	30	10	5	10
50	15	5	3	20	7	7	7	25	15	10	5
51	20	8	7	50	4	5	5	50	7	5	7
52	24	8	12	120	4	6	8	120	12	8	6
53	7	4	2	15	3	3	3	15	6	2	5
54	40	15	20	75	10	12	14	75	20	10	20
55	20	7	7	85	5	7	7	85	7	3	7
56	10	3	5	17	5	5	5	17	10	10	6
57	100	25	30	1000	20	20	25	1000	10	8	20

Subject #	Press/light switch	#Press/strongest	Pain/broken bone	Pain/mild headache	Pain/severe headache	Pain/stubbed toe	Pain/childbirth	Pain/kidney stone	Pain/elec shock	#Pain/strongest	Odor/lemon	Odor/rose	Odor/skunk
1	6	100	•	14	•	•	•	•	•	50	8	4	•
2	4	25	25	12	15	15	•	•	20	30	5	7	15
3	1	12	•	5	12	4	•	•	•	12	6	5	12
4	1	6	•	3	•	28	•	•	6	30	4	2	24
5	8	90	•	30	70	60	•	•	•	95	15	13	•
6	0.5	5	8	4	6	7	•	•	•	10	2	1	4
7	12	50	40	12	•	36	•	•	•	40	15	10	15
8	2	10	2	5	12	5	•	•	8	12	2	1	5
9	1	50	50	10	20	50	20	•	25	50	8	6	20
10	2	6	7	4	6	4	•	•	3	7	4	2	5
11	1.75	70	•	80	50	70	•	85	50	75	60	60	80
12	7	30	•	10	15	13	•	•	15	35	10	3	20
13	0.75	4	•	3	6	6	•	•	3	12	1	3	4
14	1.5	8	8.5	5.5	6.7	6.9	•	•	6	8.5	5	4.5	6.3
15	2	200	•	20	50	50	•	•	•	100	30	10	200
16	10	20	25	8	20	12	•	•	10	25	20	15	15
17	1	200	•	3	50	16	•	•	30	500	6	10	30
18	2	7	•	3	6	4	•	•	2	25	1	1.5	7
19	15	75	60	25	50	45	•	•	•	60	15	35	50
20	3	50	•	20	35	40	70	•	30	70	15	7	15
21	4	48	•	10	30	12	•	•	•	90	8	8	24
22	3	100	150	30	50	30	•	•	•	200	3	5	20
23	3	9	•	4	10	5	•	•	2	12	3	5	9
24	5	35	•	25	80	15	•	•	•	95	10	10	•
25	2	50	•	15	30	25	•	•	10	50	5	6	20
26	8	25	•	9	17	25	•	•	30	50	9	15	35
27	2	20	20	10	14	15	•	•	18	20	3	2	6
28	4	15	15	8	12	10	•	•	•	15	7	7	11
29	4	20	40	15	20	20	•	•	•	60	1	6	20
30	5	40	•	5	25	15	•	•	•	50	5	3	•
31	2	16	•	4	40	4	•	•	1	40	4	4	16
32	1	8	•	2	6	6	•	•	•	8	4	4	6
33	2	400	•	80	200	200	600	•	80	600	4	50	300
34	4	40	•	20	30	25	•	•	18	32	12	14	40
35	15	135	•	60	90	90	•	•	•	240	30	30	100
36	8	60	60	20	40	35	•	•	15	60	10	8	15
37	5	10	15	5	10	3	•	•	7	30	5.5	1	7
38	5	18	•	10	20	35	•	•	40	20	5	2.5	•
39	5	20	•	15	40	20	•	•	•	50	15	15	20
40	5	180	•	50	100	90	•	•	100	250	15	50	80
41	1	•	•	4	8	7	•	•	3	16	4	3	12
42	2	40	10	20	40	20	•	•	15	100	4	2	•
43	3	48	880	24	48	•	•	•	36	880	6	12	24
44	1	8	8	2	6	4	•	•	4	•	4	4	2
45	10	80	300	100	260	150	•	•	•	300	70	30	•
46	3	10	15	3	5	5	•	•	10	30	5	15	8
47	15	40	•	35	70	25	•	•	•	70	10	20	40
48	3	100	70	30	50	20	•	•	40	200	60	60	70
49	2.5	30	20	5	10	10	•	40	7.5	40	10	5	20
50	3	20	•	•	•	18	•	•	20	25	8	12	14
51	4	15	30	10	15	10	•	•	•	31	3	8	12
52	2	48	24	12	24	4	•	•	6	36	4	4	24
53	3	15	8	2	5	3	•	•	•	20	6	5	7
54	10	60	•	30	60	40	•	•	•	60	30	35	35
55	4	50	•	20	35	35	•	•	25	70	7	14	20
56	4	12	•	10	15	9	•	•	•	20	9	2	•
57	4	100	•	50	100	100	•	•	50	200	10	10	100

Subject #	Odor/bacon	Odor/bread	Odor/lilacs	Odor/turkey	Odor/vanilla	Odor/cocoa	Odor/apple cider	#Odor/stongest	Pung/mothballs	Pung/ammonia	#Pung/strongest	ThermWH/hot pan	ThermWH/cat/lap	ThermWH/heating pad
1	9	7	•	•	4	5	7	100	•	20	30	8	4	•
2	9	7	7	6	5	5	4	15	15	15	•	15	4	7
3	4	3	•	3	5	2	1	12	6	12	12	6	2	2
4	5	4.5	3	4.5	2	2	3	24	15	15	30	18	2	4
5	13	8	12	18	10	9	•	85	25	•	85	85	13	40
6	3	2	1	2	1	1	1	10	3	5	8	10	2	3
7	25	12	•	15	10	7	7	40	30	50	100	60	25	30
8	3	3	2	3	2	2	2	7	2	10	10	10	2	3
9	10	8	3	6	10	8	3	60	20	30	60	15	3	6
10	4	3	3	3	1	1	2	6	3	4	4	6	3	4
11	70	40	50	60	30	30	40	85	50	80	85	75	30	40
12	10	8	5	7	10	12	8	20	•	35	35	38	5	10
13	6	4	3	2	2	3	2	9	4	6	9	5	1	3
14	5.8	5	4.7	6.2	5.8	5.8	5.5	8	7.3	7.4	7.4	8.5	4.7	5.2
15	80	80	5	60	20	10	10	160	•	200	200	500	40	100
16	10	10	25	8	12	8	12	30	•	20	22	30	10	20
17	21	20	14	16	10	10	8	100	40	90	150	60	8	10
18	1.5	1.5	•	1.5	0.75	0.75	2.5	8	•	7	14	24	0.8	1.6
19	40	45	30	40	35	40	40	65	45	65	75	70	25	40
20	20	15	9	15	20	12	15	20	25	40	50	65	15	20
21	16	12	12	14	14	6	12	80	8	80	80	30	5	10
22	15	12	5	15	3	3	3	20	20	25	50	50	5	35
23	8	4	6	4	•	3	3	10	6	10	10	12	2	5
24	•	10	7	10	10	20	15	40	7	50	65	50	•	10
25	10	10	6	10	8	8	8	30	15	30	30	55	18	25
26	21	20	15	15	10	12	11	35	15	15	15	40	25	20
27	6	5	4	5	3.5	3	4	16	6	13	13	18	3.5	4.5
28	11	9	6	6	7	4	4	11	12	12	15	15	5	5
29	12	5	•	7	•	•	•	20	15	18	18	20	•	10
30	10	10	2	30	7	5	3	60	10	20	50	100	5	15
31	8	8	4	8	1	2	2	32	2	4	32	16	2	2
32	6	6	6	6	3	2	4	10	6	8	8	10	4	4
33	50	50	60	50	50	50	25	600	300	600	600	300	80	160
34	28	30	•	•	26	26	•	60	35	40	60	40	20	30
35	80	80	30	60	50	50	40	120	•	90	90	90	65	50
36	15	10	8	15	10	8	8	20	15	30	50	50	15	20
37	9	3	1	3.5	5	5	2	12	•	10	24	8	4	6
38	8	8	•	9	12	14	7	9	25	50	50	20	5	15
39	20	15	10	15	10	3	5	60	5	15	60	40	15	15
40	30	30	30	30	15	15	10	120	60	120	120	100	20	30
41	4	3	2	4	3	4	6	12	8	9	9	12	5	6
42	•	8	6	•	6	10	•	50	10	40	80	20	4	6
43	12	12	12	12	6	6	6	240	24	48	96	240	6	48
44	6	6	4	6	6	4	6	8	6	8	8	8	6	6
45	50	40	•	60	10	5	30	150	80	100	100	20	10	•
46	5	3	3	5	8	5	3	30	10	15	15	10	3	6
47	20	18	25	20	18	15	20	70	40	50	70	45	25	35
48	50	40	•	40	30	20	30	80	•	100	100	18	5	10
49	10	5	5	10	2.5	2.5	10	30	•	5	30	30	2.5	•
50	14	12	•	13	1	2	6	20	5	20	20	20	8	14
51	8	8	13	7	5	3	3	20	•	19	19	15	5	5
52	8	8	4	4	8	8	4	30	16	24	32	12	2	4
53	4	7.5	4	4	5	5	5	•	2	7	10	10	2	5
54	25	20	25	25	25	30	25	85	45	85	85	85	20	30
55	15	15	14	15	14	10	10	25	25	30	40	50	5	10
56	11	8	3	8	5	12	4	15	•	13	14	15	10	11
57	20	20	20	50	10	10	10	100	•	500	500	100	20	50

Subject #	ThermWH/hot bath	ThermWH/oven	ThermWH/hot bulb	ThermWH/scalding water	ThermWH/sun/face	ThermWH/hands/warm	ThermWH/barefoot/hot pavement	ThermWH/sunburn	#ThermWH/strongest	ThermC/cool washcloth
1	40	80	80	90	14	8	20	18	30	14
2	10	11	13	20	6	4	15	8	22	7
3	3	4	6	8	1	1	4	3	6	1
4	8	4	18	25	4	4	11	4	25	3
5	70	75	22	70	15	20	55	70	90	20
6	4	10	6	7	3	4	6	4	10	1
7	40	•	55	•	15	25	40	•	60	20
8	3	10	9	9	5	3	9	9	12	2
9	10	8	15	25	8	4	20	12	30	15
10	5	3	5	•	3	2	4	•	7	2
11	40	80	50	80	30	30	50	40	90	30
12	12	15	25	35	10	10	15	20	38	10
13	5	3	6	9	2	1	3	•	11	1
14	5.8	8.2	8.8	9.2	7	7	7.9	7.8	9.2	6.5
15	150	100	200	500	80	80	200	240	500	40
16	18	30	22	•	15	10	25	•	30	18
17	25	30	20	28	11	10	19	12	200	8
18	1.6	2.5	7	3	0.5	1	2.5	2.5	8	2
19	50	55	65	70	35	30	45	50	70	30
20	25	30	60	65	15	20	45	25	70	25
21	20	30	35	40	10	8	20	25	60	8
22	40	35	50	75	15	35	50	50	150	5
23	10	16	16	17	4	6	13	9	18	3
24	10	70	30	•	10	10	40	•	70	10
25	30	55	55	65	10	15	20	25	65	10
26	20	25	25	50	20	15	15	20	60	10
27	8	8	14	17	6	6	10	7	20	5
28	10	7	13	12	7	7	12	12	15	7
29	10	•	15	18	10	8	14	12	25	10
30	45	30	50	80	40	40	45	45	100	10
31	2	2	2	8	1	1	4	4	16	4
32	8	6	5	12	4	4	6	4	12	4
33	200	160	300	300	80	80	160	200	600	80
34	32	45	8	38	22	10	35	•	48	18
35	65	50	75	100	65	50	65	•	100	60
36	20	45	40	45	25	28	30	30	60	10
37	5	7.5	8	12	6.5	4	6.5	7	12	5.5
38	10	25	25	30	15	5	8	6	30	5
39	25	30	30	30	15	10	20	15	60	15
40	40	•	80	100	30	30	70	45	200	30
41	7	5	4	9	5	4	7	6	12	6
42	10	6	6	8	6	6	8	10	20	4
43	48	24	48	48	48	24	48	96	196	24
44	4	8	4	8	2	4	2	4	8	4
45	40	150	200	400	30	30	100	200	300	70
46	6	8	15	20	3	5	10	6	30	3
47	30	35	20	75	23	20	40	30	80	20
48	15	15	30	25	10	15	50	40	80	20
49	10	30	20	40	5	5	15	15	40	10
50	14	15	20	22	6	8	20	12	25	10
51	12	10	10	20	5	5	20	12	20	8
52	6	12	12	36	4	2	6	6	48	4
53	6	7	7	10	4	3.5	4	6	12	4
54	35	45	60	60	25	20	40	35	85	25
55	25	75	70	50	7	7	30	25	75	10
56	10	11	11	15	10	9	10	14	15	10
57	30	200	150	200	40	10	50	20	200	10

Subject #	ThermC/soda can	ThermC/ice cube/briefly	ThermC/holding ice cube	ThermC/snow	ThermC/cool shower hot day	ThermC/cold floor tiles barefoot	ThermC/cold tap water	ThermC/room temp	#ThermC/strongest	Flavor/chocolate
1	10	8	20	40	14	10	12	•	40	10
2	6	9	12	15	5	7	9	1	18	15
3	2	1	5	•	6	2	1	1	12	5
4	6	2.5	8	1	4	8	16	1.5	30	8
5	25	20	45	45	30	17	15	10	90	15
6	2	2	3	3	2	2	3	1	10	2
7	30	20	60	50	25	20	30	12	70	30
8	4	5	5	5	3	2	2	1	8	2
9	15	8	16	24	15	10	20	12	30	12
10	3	1	2	2	4	2	3	0.5	7	3
11	45	40	60	60	35	30	45	•	80	20
12	8	25	30	•	15	10	12	5	30	10
13	3	0.5	0.75	5	2	3	2	0.25	8	3
14	6.3	7.3	7.7	8.3	8	7.8	7.7	5	9.3	7
15	20	30	60	60	50	50	60	2	200	60
16	18	15	22	22	10	15	12	4	30	15
17	10	16	30	40	10	25	20	0	50	25
18	5	4	6	8	4	3	3	0.6	20	2
19	45	45	50	50	45	35	30	15	60	40
20	30	35	50	55	30	20	20	5	60	15
21	10	16	24	32	12	20	22	4	120	10
22	10	8	15	15	8	5	10	2	75	10
23	8	5	10	9	7	4	6	1	15	8
24	10	15	25	50	5	5	10	3	80	10
25	10	8	10	28	20	5	8	1	40	10
26	10	8	15	15	10	5	8	3	50	15
27	4	7	8.5	9	6.5	6	5	2	17	7
28	6	5	7	7	7	8	5	3	12	7
29	2	4	13	30	8	•	4	1	35	10
30	10	5	15	30	15	15	10	5	30	20
31	2	2	4	4	4	4	4	1	40	2
32	4	4	6	8	4	4	4	2	10	6
33	80	80	160	160	80	50	50	2	300	100
34	24	4	30	•	22	26	16	4	40	30
35	30	65	70	75	60	50	65	40	90	60
36	20	8	30	30	20	15	15	5	40	20
37	2	3.5	8	10	6	7	5	1	18	5
38	10	8	20	30	10	10	8	10	20	20
39	20	15	50	50	30	20	12	10	60	15
40	30	45	80	80	70	45	40	20	120	30
41	2	2	4	7	4	5	4	2	7	6
42	4	6	8	8	6	8	8	2	10	20
43	24	48	48	48	96	12	6	3	240	24
44	4	6	8	8	4	4	4	2	8	6
45	50	60	150	200	150	200	100	70	400	100
46	5	5	10	20	3	8	5	1.5	25	5
47	3	10	35	35	25	15	15	5	55	25
48	20	25	35	30	15	15	20	5	90	20
49	15	10	20	15	10	10	5	2.5	40	10
50	12	12	18	20	12	14	12	3	25	15
51	12	13	15	15	8	8	10	3	25	10
52	6	4	8	10	4	4	2	1	24	4
53	6	8	9	9	7	9	7	2	10	7
54	30	28	40	37	28	25	26	8	40	25
55	15	15	25	30	15	10	10	2	40	15
56	11	10	13	12	10	10	10	9	13	14
57	20	20	20	30	30	10	30	3	50	8

Subject #	Flavor/peanut butter	Flavor/vanilla	Flavor/strawberry	#Flavor/strongest	Salt/potato chip	Salt/pretzel	Salt/salt	Salt/sea water	Salt/soup broth	Salt/olive	#Salt/stongest	Sour/dill pickle	Sour/lemon	Sour/sourdough
1	14	6	2	20	6	20	20	14	12	2	20	•	20	•
2	10	8	8	25	12	10	15	8	8	10	12	12	15	7
3	3	2	4	10	4	4	10	•	4	10	10	6	10	•
4	8	4	5	16	10	12	12	15	5	3	15	12	16	4
5	15	15	15	85	13	12	25	8	10	10	60	13	28	•
6	2	2	2	7	2	2	2	2	1	3	3	2	3	1
7	15	25	25	45	25	25	30	20	20	•	35	•	30	15
8	2	2	2	8	3	5	8	7	4	4	8	5	8	2
9	8	15	10	30	20	18	70	50	15	15	70	20	30	15
10	4	3	5	6	2	3	5	4	1	0	5	3	5	•
11	20	10	30	85	40	30	75	60	20	40	80	40	70	20
12	15	10	15	20	8	15	20	25	10	10	25	10	30	5
13	2	1	2	5	2	2	4	3	1	3	6	2	4	1
14	8.8	6.7	7.2	9	6	6.3	9.2	9.1	6.4	6.6	9.5	5	6.8	6.6
15	50	30	40	200	16	8	200	•	8	8	32	32	64	6
16	18	8	20	25	18	15	30	25	15	•	30	15	20	4
17	25	16	90	90	4	8	20	90	16	30	90	8	25	8
18	2	1	2.5	6	1.5	1	4	6	0.5	•	8	2	4	1
19	50	40	35	55	40	45	55	55	35	30	65	50	60	40
20	15	5	12	50	20	17	45	30	17	25	50	15	25	10
21	15	5	15	50	10	5	30	60	15	15	60	10	30	5
22	12	8	8	20	10	8	20	20	10	5	20	8	15	10
23	7	5	8	14	10	13	18	20	5	3	20	4	20	5
24	15	10	30	70	40	20	60	•	20	70	70	30	60	•
25	10	12	12	20	12	10	15	15	8	12	20	8	15	5
26	20	10	15	30	15	12	20	29	10	8	29	5	30	2
27	7.8	6.8	8.1	13	7	5	9	8.5	4.1	5	10	5.3	9	2.5
28	7	7	6	11	7	9	10	10	9	7	10	7	10	6
29	5	8	5	25	15	10	17	20	8	•	17	1	8	2
30	10	5	10	20	10	10	30	•	15	5	30	15	30	5
31	2	2	2	20	4	2	4	2	2	2	16	2	4	2
32	6	4	2	10	4	4	10	6	4	6	10	5	6	2
33	100	50	50	300	100	50	200	200	25	100	200	100	300	25
34	28	25	28	35	25	16	35	30	20	24	35	20	35	•
35	70	50	60	150	70	50	80	50	50	90	90	90	100	60
36	20	15	15	30	10	5	30	28	8	20	30	15	40	5
37	•	3.5	•	8	6	4	8	7	4	•	8	•	8	4
38	20	25	15	20	10	•	30	15	12	8	15	8	5	7
39	15	15	15	40	10	10	12	15	12	15	30	20	20	10
40	30	40	45	•	30	30	60	20	20	30	60	10	20	20
41	8	2	6	12	10	8	12	14	6	10	14	10	14	6
42	10	10	6	30	2	•	6	4	4	•	10	•	6	4
43	12	24	24	240	6	24	48	48	6	12	96	6	48	•
44	2	4	6	8	4	4	8	6	2	2	8	4	8	2
45	70	50	90	300	100	•	150	100	•	100	200	•	200	30
46	5	5	5	20	5	3	20	10	5	•	20	5	10	1.5
47	20	15	23	70	25	25	40	20	18	30	40	19	25	8
48	30	15	10	35	50	60	70	80	60	•	80	60	80	60
49	10	5	10	20	10	10	15	5	10	5	15	7.5	15	5
50	15	5	10	25	12	15	15	20	14	6	20	10	15	10
51	9	6	9	15	8	10	12	20	9	•	20	15	17	9
52	6	2	6	12	8	6	16	12	6	12	16	4	8	2
53	6	4	5	10	8	6	10	10	4	5	12	2	10	1
54	25	16	27	45	30	30	60	60	22	•	60	30	50	12
55	15	10	20	60	15	10	80	75	25	35	80	5	20	2.5
56	13	9	14	15	5	5	12	13	10	10	13	11	17	10
57	7	3	8	20	5	8	10	20	8	1	20	8	10	2

Subject #	Sour/vinegar	Sour/sour ball	#Sour/strongest	Sweet/banana	Sweet/cherry lifesaver	Sweet/coke	Sweet/red apple	Sweet/cotton candy	Sweet/Hershey bar	Sweet/honey	Sweet/sugar	Sweet/carrot	#Sweet/strongest
1	18	20	20	14	8	4	2	10	20	30	30	•	30
2	15	12	16	8	7	10	7	15	20	22	25	4	25
3	9	12	12	5	6	10	5	10	10	5	12	1	12
4	15	10	16	7	14	16	8	3	4	8	8	1	20
5	29	•	65	15	•	12	14	•	12	25	25	6	60
6	3	•	3	3	2	4	2	4	3	3	4	0.5	4
7	25	12	30	10	24	20	12	25	25	25	25	6	30
8	8	3	10	5	4	7	4	9	8	9	9	2	10
9	40	50	50	20	25	15	10	28	22	25	30	12	60
10	5.5	6	6	1	3	3	2	5	3	5	5	0	6
11	65	50	70	20	75	50	40	70	50	75	80	20	80
12	20	25	30	8	15	8	5	20	15	15	20	3	30
13	3	6	7	1	2	3	0.75	4	3	6	6	0.5	8
14	7.8	7.9	7.9	4	6	6.5	5	6.6	6	5.8	6.6	3.5	6.7
15	192	•	128	40	50	50	20	80	100	80	200	2	200
16	18	35	35	10	18	15	8	20	15	25	20	5	28
17	30	•	50	14	20	20	20	35	40	45	50	10	60
18	6	3.5	8	1	2.5	6	1	3	4	5	3	0.2	7
19	55	45	60	30	40	35	30	45	40	50	55	10	55
20	15	•	50	20	30	32	17	40	38	45	43	2	50
21	40	30	50	10	20	30	15	40	20	50	30	5	50
22	15	30	30	10	18	10	8	18	12	12	25	3	25
23	18	17	20	7	10	9	5	17	11	14	16	1	18
24	70	80	80	10	25	25	5	70	15	40	50	5	80
25	30	30	30	5	10	15	5	15	12	15	25	2	25
26	15	15	30	2	15	9	9	12	10	15	25	0	30
27	8.1	8	11	3	6	4	3	6	6	7	7.5	3	10
28	12	11	12	4	5	6	3	8	6	7	8	2	8
29	•	15	10	8	12	14	3	15	5	•	•	1	17
30	50	50	50	5	20	10	7	20	30	15	20	3	30
31	4	4	8	4	8	4	2	16	8	16	16	1	32
32	6	4	8	2	3	4	1	3	4	6	4	•	6
33	200	300	300	50	25	200	25	200	100	200	200	4	200
34	38	32	38	8	10	6	6	12	10	11	14	7	18
35	100	60	100	42	42	55	50	60	60	60	80	25	100
36	30	20	40	10	20	25	10	40	30	35	25	5	40
37	6	5	8	1	3	2	1.5	4.5	4.5	2.5	8	0.25	9
38	10	9	10	10	12	20	8	15	12	10	20	8	20
39	30	20	30	15	15	15	10	25	15	20	30	5	30
40	50	40	60	25	45	35	25	60	30	40	60	2.5	60
41	10	16	16	6	8	8	6	12	8	14	12	2	20
42	10	6	15	2	•	2	2	6	20	20	10	8	30
43	96	48	96	3	48	3	6	24	48	96	96	0	96
44	8	6	8	2	8	4	2	8	6	8	8	2	8
45	40	60	100	40	50	30	40	60	70	70	50	30	80
46	10	20	20	5	5	10	5	20	10	20	20	5	25
47	30	40	50	10	15	10	5	30	25	30	28	8	40
48	75	70	80	25	30	•	35	70	30	60	50	5	70
49	10	10	15	10	7.5	7.5	5	•	10	15	15	2.5	20
50	18	20	20	5	15	13	10	15	15	18	18	3	20
51	•	20	20	7	12	13	6	12	12	•	15	3	15
52	16	6	16	8	10	12	6	12	10	16	12	2	20
53	15	•	12	2	4	4	4	5	6	7	10	1	10
54	42	70	72	25	35	35	25	39	25	35	50	1	50
55	15	30	30	10	30	30	12	35	15	30	25	5	40
56	16	15	17	10	10	12	9	13	14	17	20	1	20
57	10	50	50	4	8	6	5	8	6	10	10	2	20

Subject #	Bitter/blackcoffee	Bitter/celery	Bitter/dark chocolte	Bitter/beer	Bitter/aspirin	Bitter/grapefruit juice	#Bitter/strongest	OBurn/mint toothpaste	OBurn/cinnamon gum	OBurn/jalapeno	OBurn/medium salsa	OBurn/hot salsa
1	•	•	10	16	16	8	30	30	14	60	20	60
2	10	5	9	8	20	15	20	8	12	20	10	15
3	12	1	12	•	•	•	12	3	12	12	3	12
4	20	2	10	10	10	15	25	6	5	20	6	10
5	15	11	14	11	12	22	65	30	20	•	20	65
6	2	1	2	1	4	4	4	1	2	4	3	2
7	20	2	•	7	•	•	20	12	15	•	20	30
8	2	0	2	1	1	1	4	2	3	5	4	6
9	15	6	20	15	30	20	60	8	6	40	20	30
10	3	1	1	1	3	6	7	3	3	6	3	4
11	60	30	40	50	80	70	90	30	60	85	90	85
12	25	5	10	25	20	35	35	15	10	40	20	30
13	8	1	3	3	4	2	12	2	3	5	2	3
14	6	5.5	5.7	6.2	6.5	6.7	7	2.7	3.2	7.2	6.5	7
15	40	2	10	20	200	100	200	2	10	50	10	50
16	22	4	12	18	•	15	30	2	12	25	15	25
17	20	6	25	30	50	35	80	3	4	30	10	25
18	4	1	1.25	5	3	3	7	9.5	2.5	8	4.5	6
19	45	15	35	35	40	35	55	30	40	55	45	50
20	15	1	10	8	5	10	50	5	7	55	15	25
21	20	5	15	15	60	25	80	10	15	60	30	50
22	•	5	10	•	20	10	30	10	10	30	20	30
23	•	1	8	•	10	13	15	4	5	15	10	16
24	85	2	20	20	70	65	100	2	5	40	30	70
25	25	1	15	10	30	15	35	15	5	40	15	30
26	10	1	10	8	15	10	15	2	5	25	15	15
27	4.3	2.5	6.7	3	5	7	9	9	7.5	12	8.1	9.5
28	8	3	3	4	2	10	10	5	6	11	5	10
29	•	1	3	7	9	6	22	2	5	•	8	11
30	30	1	3	40	20	10	40	1	5	20	10	20
31	8	1	2	2	16	4	32	2	4	8	4	8
32	2	•	2	•	•	•	2	2	3	6	3	4
33	200	25	25	25	200	100	200	4	8	600	200	300
34	30	2	12	16	22	8	35	8	6	20	10	18
35	35	45	35	55	•	50	70	30	60	80	70	85
36	20	1	5	10	30	25	40	1	1	20	5	15
37	3.5	1	7	2	0.5	1	8	1.5	3	12	6	8
38	15	8	10	8	12	8	12	5	8	15	9	15
39	25	5	10	15	20	20	30	5	10	20	15	20
40	40	10	50	60	60	20	60	30	30	90	45	90
41	14	6	2	8	4	12	14	6	8	16	10	12
42	20	•	20	10	6	8	15	6	8	•	•	•
43	480	0	4	24	3	12	480	48	48	24	6	48
44	8	6	6	6	8	4	8	2	4	8	4	8
45	6	•	40	90	70	50	90	70	30	80	60	90
46	5	1.5	3	5	10	8	20	5	5	10	8	20
47	28	2	19	25	30	15	60	2	3	15	10	20
48	25	5	20	30	10	40	60	15	18	60	20	40
49	10	10	15	5	5	10	15	5	7.5	15	7.5	15
50	10	2	5	•	•	15	15	0	5	20	8	16
51	•	1	3	•	7	10	•	5	5	15	6	12
52	8	2	4	6	10	8	12	6	8	16	12	16
53	6	4	1	4	8	6	9	4	5	12	7.5	9
54	25	5	5	10	15	20	35	19	28	55	30	45
55	20	5	15	15	30	15	60	5	7	30	15	20
56	16	11	10	10	17	16	17	2	10	5	2	10
57	•	20	15	•	20	25	30	5	10	50	20	40

Subject #	O8urn/yellow mustard	O8urn/cola	O8urn/ginger cookie	#O8urn/strongest	OPain/biting tongue	OPain/toothache	OPain/canker sore	#OPain/strongest	OralWH/hot tea/coffee	OralWH/warm bread	OralWH/hot pizza
1	16	12	12	100	80	60	20	80	80	14	60
2	10	11	8	25	20	10	12	30	15	7	20
3	1	2	2	12	5	4	3	7	12	4	12
4	1.5	0.5	0	30	5	12	15	15	15	2	29
5	•	10	•	85	75	85	80	95	40	15	60
6	2	1	1	7	7	7	5	8.5	4	2	7
7	6	12	3	45	30	20	10	30	25	17	45
8	2	0	1	12	6	•	•	16	5	2	8
9	12	3	2	80	15	•	15	15	15	12	20
10	2	2	0	6	5	2	•	6.5	4	2	4
11	50	40	60	90	65	90	60	90	85	40	90
12	10	15	•	40	20	25	•	45	15	10	20
13	1.5	2	0.5	8	4	3	2	8	3	2	5
14	6.8	5	5.4	9.8	8	7.5	7.6	8	8	7	7.9
15	20	10	5	200	100	80	200	200	100	2	180
16	8	4	•	25	20	•	18	28	18	10	25
17	8	1	0.25	150	50	90	5	150	20	8	25
18	2	1.5	1	15	2	3	3	25	3	1	4
19	35	25	15	65	45	60	40	65	55	30	45
20	20	2	5	50	50	25	45	50	35	20	48
21	20	25	15	80	40	•	30	60	20	5	40
22	20	10	5	40	40	•	10	40	25	20	35
23	1	3	2	16	13	9	10	15	9	6	18
24	2	5	2	80	75	30	•	75	40	10	45
25	10	10	5	60	25	35	48	48	15	10	40
26	9	2	1	30	10	20	8	40	15	10	25
27	10	6	5	12	12	13	7	15	7	4.5	7
28	4	5	5	11	12	14	11	14	6	6	13
29	3	2	•	17	11	•	•	40	15	4	•
30	10	30	3	30	30	•	5	30	20	10	30
31	1	2	2	32	8	4	8	32	4	1	8
32	2	2	•	6	8	6	10	10	4	3	8
33	25	8	4	600	200	200	80	600	200	8	400
34	4	12	•	40	32	•	8	40	40	32	36
35	40	40	30	80	105	200	•	200	80	60	100
36	3	1	1	20	30	50	25	50	20	10	40
37	•	6.5	•	12	5	8	•	8	6	2	4
38	10	40	•	15	15	25	20	20	15	5	25
39	15	5	3	25	30	20	15	30	15	10	30
40	45	7.5	5	120	90	60	90	120	50	30	90
41	4	2	2	22	12	14	8	14	8	10	14
42	•	10	8	6	8	10	•	10	10	6	8
43	24	12	•	480	480	480	•	480	240	120	480
44	6	4	4	8	4	8	6	8	6	4	8
45	50	60	5	90	150	200	•	200	100	50	10
46	3	3	5	30	5	5	10	25	3	1.5	10
47	12	2	1	75	35	30	25	35	35	25	50
48	10	5	•	70	20	40	25	100	10	5	40
49	5	5	7.5	40	5	20	5	20	10	5	15
50	0	2	•	20	18	16	•	18	18	8	20
51	3	12	2	18	17	14	17	25	21	11	22
52	4	2	2	32	16	4	8	16	12	6	24
53	6	5	2	10	10	6	6	10	6	3.5	6
54	12	15	2	45	65	40	60	80	40	12	49
55	10	7	5	55	45	30	20	55	25	10	55
56	9	2	2	17	16	20	15	20	12	10	14
57	20	15	10	100	100	40	20	1000	20	10	30

Subject #	#OralWH/strongest	OralC/ice cube	OralC/tongue to ice	OralC/room temp	#OralC/strongest	FlOdor/violet	FlOdor/lilac	FlOdor/rose	#FlOdor/strongest	FrOdor/orange	FrOdor/banana	FrOdor/pear	#FrOdor/strongest
1	100	40	30	20	40	6	•	8	20	8	14	6	20
2	20	15	16	5	16	10	14	13	14	9	10	6	10
3	12	3	6	1	12	1	•	5	5	5	3	3	5
4	27	15	8	3	15	1	10	5	15	5	3	2	8
5	90	60	50	10	65	12	12	13	40	12	11	10	35
6	8	3	4	1	6	1	1	1	2	2	1	1	2
7	45	45	30	10	45	20	•	25	25	20	10	•	50
8	10	5	5	1	8	0	5	1	5	4	1	1	8
9	20	20	15	10	40	2	3	6	6	6	2	3	20
10	4	3	5	2	6	1	3	1	3.5	4	2	1	5
11	90	75	70	20	80	50	65	70	80	65	40	35	70
12	20	15	13	5	15	5	5	3	20	10	5	8	20
13	8	3	2	0.5	6	1	2	3	3	2	0.5	0.75	4
14	8.5	7.7	8.2	5	8.4	5	5.3	5	6.2	6.1	5	4.7	6.3
15	180	100	50	2	120	2	5	10	•	15	5	2	30
16	25	20	15	5	20	•	25	15	30	10	10	8	15
17	60	55	20	0	85	8	10	6	18	13	1	2	15
18	4.5	2	4.5	1	7	•	•	1.9	10	1	0.9	0.7	1
19	55	60	55	30	60	30	30	40	40	40	25	35	45
20	50	50	45	10	50	1	10	8	10	20	8	10	25
21	45	60	30	5	80	5	30	20	40	20	10	5	30
22	35	25	20	5	25	5	5	5	5	5	6	4	8
23	20	11	15	1	20	•	9	7	15	18	7	4	18
24	60	40	80	5	80	2	5	10	10	5	5	0.1	80
25	40	25	25	10	25	10	10	6	20	10	10	5	10
26	40	25	10	2	30	10	15	10	20	8	2	2	10
27	15	8	11	3	16	3	3	4	4.5	3.8	2	1.5	3.8
28	13	7	7	3	8	7	7	8	10	7	6	3	8
29	20	15	12	1	18	•	•	6	•	7	9	0	11
30	30	40	10	5	40	3	3	5	5	20	5	5	20
31	16	8	2	1	8	2	4	8	8	4	8	2	8
32	8	4	4	•	10	2	4	4	6	4	•	•	6
33	400	200	100	4	200	30	60	50	60	60	50	25	60
34	45	30	40	12	42	•	•	30	35	28	16	18	30
35	125	80	90	30	80	35	35	35	45	50	30	20	65
36	40	40	10	5	40	5	10	8	12	2	8	3	8
37	7	6.5	3	2	10	2.5	1	3	3	4	1	0.5	4
38	25	20	30	10	20	2.5	2.5	5	5	5	2.5	1	7
39	40	20	10	5	40	10	10	15	20	20	15	12	25
40	120	50	75	10	100	30	45	60	75	20	30	20	60
41	14	6	8	2	8	6	4	8	8	6	4	4	6
42	10	20	8	2	20	4	4	2	10	6	2	4	10
43	480	120	240	0	480	12	12	12	120	24	6	6	120
44	8	6	4	4	6	2	4	4	8	6	4	2	6
45	150	100	70	30	100	60	70	40	60	30	40	50	60
46	20	15	5	1.5	15	1	3	1.5	6	5	1	0.5	5
47	70	30	18	2	45	1	30	20	40	20	10	15	30
48	40	30	20	5	50	•	•	30	45	20	15	10	30
49	15	20	10	5	30	7.5	5	5	10	10	15	5	15
50	20	15	6	1	17	5	•	10	10	10	12	6	12
51	22	20	16	3	22	10	20	10	•	15	3	4	15
52	24	16	8	2	24	4	4	4	12	6	8	2	12
53	7	8	8	3	8	4	4	4	5	6	4	5	7
54	49	35	39	10	35	25	25	35	35	25	20	15	30
55	55	30	20	10	35	7	14	14	20	10	15	5	20
56	15	13	14	9	13	3	3	4	6	8	12	6	13
57	50	30	40	5	80	5	5	5	15	15	5	3	15

Subject #	SweetBev/lemonade	SweetBev/comm iced tea	SweetBev/Pepsi	#Sweetbev/strongest	STRONGEST SENS EXP	SCALE MAX	Barely Detectable	Weak	Moderate	Strong	Very strong	Strongest Exp	Scale Max	3dB_98
1	4	4	14	50	100	150	1	6	20	40	80	100	150	30
2	10	15	15	20	30	120	1	3	10	15	25	30	120	12
3	•	•	6	12	12	36	0.5	1.5	5	9	12	12	36	4
4	8	10	8	10	30	50	1	5	15	25	24	30	50	14
5	13	13	13	35	95	100	1	7.5	20	45	60	95	100	12
6	1	3	4	4	10	20	0.5	1	3.5	8	9	10	20	4
7	15	25	20	30	100	120	1	5	15	30	70	100	120	24
8	5	7	8	10	16	18	1	3.5	7.5	12	14	16	18	4
9	10	10	15	30	100	200	0.25	1	12	20	50	100	200	15
10	3	2	2.5	5	9	10	1	2	3	5	7	9	10	5
11	70	60	70	80	90	110	5	10	25	60	70	90	110	20
12	15	13	10	25	40	60	3	5	13	30	40	60	•	13
13	2	3	4	6	30	45	1	2	7	12	20	30	45	4
14	6.4	6.2	6.5	7.4	10	15	2.6	4.6	5.3	7.6	8.3	10	15	5.3
15	10	30	60	100	200	400	2	10	25	100	150	200	400	10
16	12	15	15	20	35	50	2	8	10	20	25	35	50	22
17	15	12	12	20	500	700	0.25	1	6	25	50	500	700	10
18	1	4	6.5	7	25	75	0.005	0.3	2.5	5.5	7	25	75	6
19	25	50	50	65	85	100	1	7.5	20	45	70	85	100	45
20	20	17	23	30	70	82.5	1	10	22.5	45	60	70	82.5	35
21	20	40	35	60	120	480	1	5	8	20	40	120	480	16
22	12	•	8	25	200	200	1	3	10	30	75	200	200	25
23	20	•	15	20	20	25	1	3	10	15	18	20	25	11
24	20	20	30	30	100	120	1	5	15	30	50	100	120	80
25	20	20	25	30	65	80	1	5	30	50	65	65	80	15
26	15	10	10	25	100	60	0.2	2	8	20	25	60	100	15
27	7	5	5.5	7	20	26	0.3	0.7	3.5	8	10.5	20	26	6
28	11	9	10	11	20	22	3	5	7	10	15	20	22	10
29	6	8	12	15	60	75	1	2	12	22	50	60	75	15
30	15	20	20	20	60	80	0.5	5	10	30	60	60	80	20
31	2	8	4	16	40	60	0.5	1	2	4	8	40	60	4
32	4	6	6	8	14	20	0.5	1	2	7	10	14	20	6
33	100	100	200	300	600	600	0.25	1	50	100	400	600	600	8
34	20	16	18	28	80	100	2	4	16	40	60	80	100	16
35	60	60	70	70	240	960	10	30	50	80	120	240	960	80
36	10	20	15	25	100	150	1	5	15	50	65	100	150	10
37	4	6	5	12	30	40	0.2	0.5	5	7.5	10	30	40	8
38	5	5	20	20	100	150	3	8	10	20	50	100	150	15
39	15	20	15	30	80	120	3	5	15	20	40	80	120	30
40	20	40	50	60	250	400	1.5	5	30	55	87.5	250	450	55
41	4	6	10	10	22	26	2	6	10	14	18	22	26	10
42	6	4	2	6	100	150	1	2	10	20	40	100	150	6
43	24	48	0	480	880	1760	1.5	3	42	92	240	880	1760	12
44	2	2	4	6	8	10	0.2	0.5	3	6	8	8	10	6
45	60	70	60	80	400	700	3	10	50	200	400	400	700	30
46	5	15	10	15	30	50	0.5	1.5	5	10	20	30	50	5
47	10	25	28	40	80	95	2	8	17	25	35	80	95	20
48	20	30	•	40	200	600	1	10	60	75	100	200	600	50
49	5	10	10	20	40	50	1	5	15	25	40	40	50	8
50	10	8	8	15	25	30	1	3	10	15	20	25	30	14
51	11	13	13	15	50	62.5	1	3	7	15	20	50	62.5	18
52	4	8	8	16	120	200	2	6	16	32	64	120	200	12
53	8	10	10	10	20	25	0.5	2	5	7	10	20	25	10
54	30	25	25	45	85	100	1	3	25	50	75	85	100	30
55	10	30	20	30	85	100	0.3	1	10	20	40	85	100	20
56	11	10	13	14	25	40	1.5	5	10	15	20	25	40	10
57	15	10	20	20	1000	2000	1	3	5	20	50	1000	2000	70

Subject #	3d8_86	3d8_74	3dB_62	3d8_50	4d8_98	4d8_86	4d8_74	4d8_62	4d8_50	A_1M NaCl	A_0.32M NaCl	A_0.1M NaCl	A_0.032M NaCl	A_0.01M NaCl	AdB_98	Ad8_86	Ad8_74	AdB_62	AdB_50	8_1M NaCl
1	16	8	4	2	30	16	4	1	1	8	9	1	2	0	30	14	8	3	1	20
2	7	5	2	1	15	10	4	3	1	12	8	0.5	5	0.5	16	11	4	4	1	14
3	3	2	1	0.5	6	5	4	0.5	0.5	9	4	1	0.5	0.5	6	4	2	1	0.5	6
4	6	7	2	1	16	6	5	4	2	14	10	3	2	1	9	5	3	2	1.5	15
5	4	2	1	0.5	11	5	2	0.8	0.5	15	10	4	2	1	12	9	2	0.7	0.3	25
6	2	1	0.5	0.5	4	1	1	0.5	0.5	2	2	1	1	1	3	1	1	1	0.5	2
7	15	12	8	5	30	12	10	8	5	25	20	8	3	1	30	20	10	5	4	27
8	3	1	1	1	5	2	1	1	1	6	4	1	1	0	4	2	1	1	0.5	6
9	10	8	7	5	15	11	6	5	3	40	12	10	4	1	20	8	8	5	3	50
10	3	2	2	1	5	4	2	1	2	4	3	2	1	0	5	3	2	1	1	5
11	10	9	5	2	10	7	5	2	1	40	15	7	2	5	20	10	7	5	5	40
12	9	7	6	4	17	12	5	4	3	25	13	10	3	3	14	12	7	4	3	33
13	2	0.75	0.5	0.5	3	1	0.75	0.75	0.25	4	3	1	0.75	0	4	2	1	0.75	0.25	6
14	3.5	3.1	2.5	1.8	5.1	4.4	3.2	2.6	2.6	5	3.6	3.6	1.7	1.2	5.2	3.8	3	3	1.4	5
15	6	4	2	1	10	5	4	1	1	12	10	3	1	1	11	6	2	3	1	9
16	18	10	5	2	20	15	5	4	2	25	12	8	2	1	20	10	4	4	2	20
17	4	5	2	0.5	8	4	1.5	1	1	45	6	0.5	0.125	0	10	4.5	2	1	0.25	45
18	0.5	1.5	1.5	0.5	6	4	1.25	0.7	0.75	4	4.5	2	1	0.5	4.5	3	1.5	0.8	0.4	6
19	35	20	10	5	55	35	30	15	5	55	30	5	5	5	55	20	20	10	5	65
20	25	8	10	5	40	8	7	5	3	25	10	5	2	0	20	7	5	3	4	15
21	10	5	5	3	21	7	5	3	2	15	10	7	5	2	25	8	4	4	2	24
22	10	6	2	2	25	10	6	2	2	15	10	3	1	1	10	10	2	2	1	15
23	6	5	3	2	13	7	4	2	1.5	10	17	3	1.5	1	11	8	5	2.5	2	18
24	30	5	2	1	85	20	5	2	1	70	20	20	1	0	80	30	10	2	1	80
25	7	3	3	2	15	6	3	4	2	10	8	2	1	2	13	6	6	2	2	15
26	5	4	3	2	20	8	4	2	1	18	9	8	4	3	12	5	2	2	1	25
27	2	3	1	0.7	7	3.2	1.5	2	0.6	7.5	7	4	3.5	0	5	3	2.5	1.8	1	9.3
28	7	5	3	2	11	7	5	4	2	13	10	8	3	4	11	7	5	3	2	12
29	11	9	2	1	15	9	9	4	1	17	13	13	0	0	15	12	10	1	1	17
30	10	5	3	2	30	10	5	3	1	10	5	3	0	0.5	30	10	5	2	2	30
31	4	2	2	1	8	4	2	1	1	8	4	2	2	1	8	4	1	1	2	8
32	4	2	1	1	6	2	1	1	0.5	4	2	1	0	0	8	3	1	1	0.5	9
33	4	4	2	1	8	4	2	1	1	8	8	6	2	1	8	4	2	1	1	8
34	8	8	4	2	16	8	4	4	2	19	12	10	2	2	18	8	12	4	2	40
35	50	30	35	30	85	50	35	25	20	90	60	30	20	20	75	50	45	25	20	75
36	5	2	1	1	12	2	3	1	0.5	7	9	3	0.5	0	8	5	2	2	1	13
37	4.5	3	2	0.5	11	4.5	2	1	0.5	10	6	0.5	0.25	0.1	11	5	3	0.5	0.25	11.5
38	12	8	6	5	25	10	12	4	1	15	18	10	1	0	12	10	8	5	1	20
39	12	5	3	5	30	15	5	3	3	50	20	15	3	1	30	5	3	1	3	50
40	30	10	5	2.5	75	25	10	5	2.5	30	15	7.5	2	0	50	20	10	5	2.5	15
41	8	5	3	2	13	12	6	4	2	16	14	12	4	2	12	10	6	6	2	17
42	4	2	1	0.5	8	4	2	0.5	0.25	6	2	3	1	1	6	3	2	2	1	10
43	3	2	3	1.5	12	3	2	2	0.5	36	24	6	12	0	12	6	2	3	1.5	24
44	2	2	1	2	6	4	2	1	1	6	5	2	0.5	0	4	4	1	1	1	6
45	30	10	5	5	50	30	15	10	5	80	60	40	5	5	50	30	10	10	5	60
46	3	2	1.5	1	8	5	3	3	0.5	5	3	1	1	0	8	5	3	1	0.5	10
47	13	10	7	5	28	12	8	5	4	30	20	5	2	0	22	14	9	6	4	35
48	30	10	5	2	60	20	10	3	2	70	50	35	15	8	50	20	10	5	2	80
49	5	3	2	1	8	6	3	1	0.5	10	7.5	2.5	1	1	8	5	2	1	0.5	12
50	8	4	2	2	14	8	4	1	1	12	2	5	3	1	12	4	4	2	1	15
51	8	5	7	3	17	12	7	3	2	19	15	6	3	1	16	9	7	6	4	21
52	6	6	4	2	12	8	4	4	2	12	4	2	0	0	12	6	3	2	2	12
53	3.5	3	1	0.5	10	5	1	0.5	0.5	7	12	1	0.5	0	7.5	6	3	2	0.5	16
54	18	12	5	2	30	18	5	2	2	25	25	30	15	10	35	20	16	2	1.5	15
55	10	7	5	2.5	25	10	5	3	2	30	15	5	2.5	0	20	10	7	5	5	25
56	5	7	4	1	15	10	3	1	0.5	12	12	11	5	2	15	10	5	3	2	14
57	18	10	7	3.5	50	20	5	6	3	25	8	9	4	2	40	30	10	6	4	30

Subject #	8_0.32M NaCl	8_0.1M NaCl	8_0.032M NaCl	8_0.01M NaCl	8d8_98	8d8_86	8d8_74	8d8_62	8d8_50	C_.0032M Prop	C_.001M Prop	C_.00032M Prop	C_.0001M Prop	C_.000032M Prop	Cd8_98	Cd8_86	Cd8_74
1	20	2	0	0	40	20	6	4	1	8	2	3	1	0	40	20	10
2	7	7	0	1	15	5	7	1	1	18	7	2	12	1	10	8	4
3	4	0.5	0.25	0.25	6	4	1	0.5	0.5	6	2	3	0	0	6	4	2
4	10	7	1	0.5	10	5	3	2	1	17	17	7	10	0	9	7	3
5	12	2.5	2.5	1	12	4.5	2	1	0.3	9	5	3.5	3	3	12	5	1
6	1	0.5	1	0.5	2	2	1	0.5	0.5	2	1	0.5	0.5	0.5	2	1	0.5
7	12	2	0.3	0.5	25	20	8	6	4	5	2	0.3	0.3	0.5	25	15	8
8	4	2	1	0	3	2	1	1	1	4	6	3	2	1	4	3	1
9	15	7	1	1	15	10	9	5	2	90	70	50	30	3	20	8	10
10	3	1	1	0	5	3	2	2	1	4	3	1	0	1	5	3	2
11	20	7	3	2	15	6	7	5	2	5	2	3	2	2	15	10	5
12	20	8	4	3	20	10	6	5	3	30	20	15	5	3	15	10	6
13	3	1	0.75	0.25	3	1	0.75	0.5	0.5	12	8	4	2	2	4	2	1
14	3.5	2.2	2.3	2.2	5	3	1.8	1.6	1.6	3.3	2.6	2.5	2.6	2.5	5.2	4	2.7
15	10	3	1	1	7	4	2	1.5	1	12	15	9	5	3	8	2.5	2
16	12	4	1	0	22	8	5	4	2	30	30	22	5	8	25	12	5
17	8	3	0.125	0	30	14	8	0.5	2	15	0.125	0.125	0.25	0.25	36	5	3
18	3.75	1.5	0.075	0.075	6	3	1.5	0.75	0.5	3	1.5	0.3	0	0	6	3	1.5
19	50	20	1	3	60	30	10	5	3	65	40	25	5	15	60	35	10
20	12	3	1	1	35	12	5	3	4	0	0	0	0	2	20	5	4
21	18	6	2	1	24	12	6	6	4	15	6	10	4	3	24	16	8
22	10	3	3	1	25	6	4	2	2	10	5	1	3	1	25	8	4
23	15	5	2	1	11	5	4	3	2	14	14	2	2	1	12	7	4
24	50	10	1	0	80	30	5	2	1	95	70	50	5	5	85	25	5
25	7	2	2	0	15	6	6	2	1	5	1	2	1	0	15	8	5
26	10	4	3	2	12	10	4	2	1	25	8	3	1	1	15	5	3
27	6	3.2	1.8	0.3	6	3	2.5	2.9	1	8	10	1	0.3	0.7	6	4	3
28	11	4	3	1	9	7	5	2	1	10	7	5	4	5	10	7	5
29	13	5	1	0	18	15	12	5	2	22	17	6	3	9	15	11	4
30	5	2	1	0	25	10	5	2	1	40	15	10	15	3	30	10	5
31	4	2	1	0.5	8	2	2	1	0.5	8	8	2	4	1	8	4	2
32	6	0	0	1	8	2	2	1	1	8	8	0	1	1	8	4	2
33	6	2	1	0.5	8	4	4	2	1	12	4	6	2	2	8	4	1
34	20	8	2	2	18	8	8	4	2	32	16	8	2	4	16	8	8
35	60	30	25	25	75	50	50	20	15	75	60	55	40	40	80	50	50
36	5	3	2	0	6	3	2	2	0.5	20	5	1.5	0	0.5	6	3	1.5
37	5	2	0.1	0.1	12	8.5	3	0.5	0.25	14	11.5	8	5	0.1	10.5	8.5	3
38	18	12	4	2	15	8	5	3	3	35	28	25	25	1	15	5	3
39	40	3	1	0	30	15	1.5	3	3	12	5	3	1	0	30	15	3
40	15	5	1	0	50	15	10	5	2.5	30	45	30	10	5	55	20	10
41	15	12	2	2	12	10	4	2	1	19	18	16	15	10	12	10	5
42	8	6	1	1	4	2	1	0.5	0.5	3	2	4	1	1	6	4	2
43	6	3	0	0	12	6	4	3	1.5	24	1.5	0	6	0	12	6	4
44	4	2	1	0	6	4	2	2	1	9	9	8	4	2	6	2	2
45	50	30	10	5	50	30	10	5	5	100	80	80	30	20	50	30	10
46	5	1	0	0	8	5	4	1	0.5	1	0.5	0	0	0.5	8	4	2
47	24	6	1	0	27	16	13	7	3	10	2	3	1	0.5	22	19	16
48	65	30	5	2	40	20	10	5	3	15	2	1	2	1	40	12	10
49	12	2.5	1	1	8	5	2	1	0.5	5	5	2	2	2	8	5	4
50	5	4	1	1	14	8	4	2	1	15	10	5	2	1	14	8	3
51	18	3	1	1	14	10	7	6	4	20	22	6	9	3	16	11	8
52	6	2	2	0	12	6	4	3	2	6	4	2	0	1	12	6	6
53	13	4	1	0	8.5	4	4	9	0.5	10	6	3	2	0	7	4	3
54	30	25	12	2	35	20	16	2	1.5	35	20	30	16	10	35	25	10
55	20	5	2.5	0	20	7	6	5	2.5	15	10	5	2.5	2	20	10	7
56	12	7	3	3	17	10	4	2	1	15	17	5	3	3	18	11	2
57	12	3	2	1	25	20	12	6	4	15	9	10	5	3	20	8	4

Subject #	Cd8_62	Cd8_50	D_.0032M Prop	D_.001M Prop	D_.00032M Prop	D_.0001M Prop	D_.000032M Prop	Dd8_98	Dd8_86	Dd8_74	DdB_62	Dd8_50	Prop Paper	Barely Detectable	Weak	Moderate	Strong	Very Strong
1	4	2	12	4	1	1	1	30	16	8	2	1	2	1	4	20	30	40
2	3	1	9	14	12	6	2	12	10	4	4	1	20	0.5	3	10	20	30
3	1	0.5	4	4	2	0.5	0	6	6	1	1	0.5	4	0.2	1.5	4	7	9
4	2	1	10	6	4	1	1	10	3	5	1.5	0.5	12	0.5	2	11	23	26
5	0.5	0.5	3	3.5	1.5	3.5	2	12	2	1	0.8	0.3	11	0.1	10	20	45	60
6	0.5	0.5	2	1	0.5	0.5	0.5	3	2	1	0.5	0.5	1	0.5	0.5	3	8	9
7	4	2	7	1	0.5	0.3	0.7	25	10	8	5	3	5	0.5	3	15	30	45
8	1	0.5	4	2	1	1	0	4	3	2	1	1	4	0.5	2.5	6	10	14
9	5	3	70	50	40	20	3	20	12	10	6	3	80	0.25	2	12	20	50
10	1	0.5	4	3	1	1	0	4	3	2	2	1	4	1	2	3	4.75	7
11	3	2	72	2	3	2	20	10	7	5	3	2	5	2	5	10	20	40
12	5	3	25	10	5	3	2	22	8	5	4	3	15	2.5	5	13	25	40
13	0.5	0.25	15	11	4	1	0	3	2	1	0.75	0.25	20	1	3	7	12	20
14	2.8	2.5	4.1	3	2.8	2.45	2.5	5.3	3.3	3.1	4.2	2.3	5.4	2.6	3.9	4.2	5	6
15	1	1	•	15	12	9	5	2	5	3	2	1.5	18	1	2	100	150	200
16	4	2	30	25	15	10	2	22	10	4	4	2	30	2	6	10	20	25
17	1	0.75	45	12	5	0.25	0	40	6	4	0.5	0.5	23	0.5	2	4	10	30
18	1.5	0.75	3.5	1	0.75	0	0.075	6	3	1.5	0.75	0.75	0.7	0.05	0.25	1.5	6	9
19	5	3	50	15	20	10	10	50	30	20	10	3	65	1	10	25	45	65
20	3	2	1	1	2	0	1	15	6	3	2	1	0	0.5	10	20	42.5	60
21	4	2	16	8	6	4	4	18	6	6	3	2	6	0.5	4.5	9	16	30
22	4	2	15	10	8	3	1	25	10	6	4	2	15	1	3	10	30	75
23	2	1.5	2.5	4.5	5	1.5	1	9	6	3	2	1.5	18	1	3	10	15	18
24	2	1	97	65	30	20	2	85	20	10	2	1	100	1	5	15	30	60
25	2	2	4	2	2	1	0	17	6	3	2	2	8	1	5	15	35	50
26	2	1	15	7	3	1	2	12	8	4	2	1	21	0.2	5	10	25	35
27	3	2	5.5	1.5	0.2	0.2	0.2	5	3.3	3	3	2.8	6.5	0.3	2.5	7	11	17
28	3	2	11	7	4	4	7	11	5	5	2	1	9	1	3	7	10	15
29	2	1	21	20	10	4	1	15	12	8	4	2	12	1	2	12	22	50
30	3	1	60	10	10	3	0	35	10	5	2	2	45	1	5	10	30	60
31	2	1	4	2	1	1	1	8	4	2	2	1	32	0.5	1	2	4	8
32	1	1	8	4	1	0	0	6	4	1	1	1	5	0.5	1	2	6	8
33	1	0.5	16	6	4	0.5	0.5	8	4	2	2	1	8	2	8	32	64	400
34	4	2	10	15	3	2	5	16	8	8	6	4	30	2	6	16	30	50
35	20	15	65	70	55	60	40	75	50	45	30	20	85	5	30	40	65	90
36	1.5	1	7	6	1	0.5	0	7	3	3	2	2	4	1	5	15	60	75
37	0.5	0.25	9	7	5.5	2	0.1	8	6	3	1	0.5	14	0.05	2	5	8	10
38	4	2	50	30	35	15	3	12	8	5	4	3	40	1	4	8	20	30
39	1.5	1.5	25	7	3	3	1	30	7	5	3	1.5	15	2	5	15	20	35
40	5	2.5	45	25	10	5	5	50	10	5	5	2.5	80	1.5	5	30	50	87.5
41	2	3	14	12	15	6	4	12	4	3	3	1	19	2	5	8	12	16
42	1	0.5	4	2	2	1	1	6	3	2	1	0.5	4	0.25	1	3	6	8
43	3	1.5	48	6	12	0	0	12	6	3	2	1.5	48	1.25	6	24	8	240
44	1	0.5	8	8	3	2	0	8	4	2	1	1	8	0.2	1	5	6	8
45	5	5	100	80	50	20	10	50	30	10	10	5	60	1	10	40	100	200
46	1	0.5	3	1	0.5	0	0	8	4	3	0.5	0.5	5	0.5	1.5	5	10	20
47	4	2	18	9	0	1	0.5	30	20	8	3	2	24	2	10	20	35	45
48	5	3	20	4	1	1	1	65	20	8	5	3	15	1	5	30	70	100
49	1	0.5	8	5	2	1	5	8	4	2	1	0.5	10	1	4	15	25	40
50	2	1	8	7	5	1	1	12	6	4	2	1	16	1	2	8	15	20
51	6	3	14	4	1	1	1	16	11	5	6	4	20	1	3	4	10	16
52	4	2	8	2	0	2	0	16	6	8	4	2	4	2	6	12	32	60
53	1.5	0.5	4.5	7.5	2.5	0.5	0	10	5	3	2	1	5	0.5	2	5	7	10
54	7	2	30	25	12	15	12	35	20	8	8	1	50	1	15	25	50	75
55	5	3	15	15	7	5	2	25	7	5	2.5	2	15	0.3	1	10	20	40
56	3	0.5	10	8	6	2	3	16	13	8	3	2	12	3	6.5	10	17	23
57	3	2	12	10	5	6	2	30	10	6	5	3	8	2	4	5	10	20

Subject #	Strongest Sensation Experienced	Maximum Intensity on Scale	Strngst Sen Exper (non-oral)	NF=100/strgst sen
1	80	100	80	1.25
2	30	120	30	3.333333333
3	12	36	12	8.333333333
4	30	50	30	3.333333333
5	95	100	95	1.052631579
6	10	20	10	10
7	100	120	100	1
8	16	18	16	6.25
9	100	200	100	1
10	9	10	9	11.11111111
11	90	150	90	1.111111111
12	40	60	40	2.5
13	30	40	30	3.333333333
14	10	15	10	10
15	500	1000	500	0.2
16	38	50	38	2.631578947
17	500	700	500	0.2
18	25	75	25	4
19	85	100	85	1.176470588
20	70	82.5	70	1.428571429
21	120	240	120	0.833333333
22	200	200	200	0.5
23	20	25	20	5
24	100	120	100	1
25	65	80	65	1.538461538
26	60	100	60	1.666666667
27	20	26	20	5
28	20	22	20	5
29	60	75	60	1.666666667
30	60	80	60	1.666666667
31	40	60	40	2.5
32	10	14	10	10
33	600	600	600	0.166666667
34	80	100	80	1.25
35	240	960	240	0.416666667
36	100	150	100	1
37	30	40	30	3.333333333
38	80	120	80	1.25
39	80	120	80	1.25
40	250	400	250	0.4
41	20	30	20	5
42	100	150	100	1
43	880	1760	880	0.113636364
44	8	10	8	12.5
45	400	700	400	0.25
46	30	50	30	3.333333333
47	80	95	80	1.25
48	200	600	200	0.5
49	40	40	40	2.5
50	25	30	25	4
51	50	60	50	2
52	120	200	120	0.833333333
53	20	25	20	5
54	85	100	85	1.176470588
55	85	100	85	1.176470588
56	20	30	20	5
57	300	350	300	0.333333333

Appendix 3

Correlation coefficients of data normalized to strongest nonoral sensation: PROP bitterness vs other sensations

Regression Summary
Sound/bee vs. Prop Paper

Count	57
Num. Missing	0
|R|	.290
R Squared	.084
Adjusted R Squared	.067
RMS Residual	6.833

Regression Coefficients
Sound/bee vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	4.574	1.414	4.574	3.235	.0021
Prop Paper	.070	.031	.290	2.247	.0287

Regression Summary
Sound/car alarm vs. Prop Paper

Count	56
Num. Missing	1
|R|	.447
R Squared	.199
Adjusted R Squared	.185
RMS Residual	19.357

Regression Coefficients
Sound/car alarm vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	29.797	4.039	29.797	7.377	<.0001
Prop Paper	.335	.091	.447	3.667	.0006

Regression Summary
Sound/car door slam vs. Prop Paper

Count	57
Num. Missing	0
|R|	.351
R Squared	.123
Adjusted R Squared	.107
RMS Residual	16.222

Regression Coefficients
Sound/car door slam vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	18.387	3.357	18.387	5.478	<.0001
Prop Paper	.204	.074	.351	2.775	.0075

Regression Summary
Sound/conversation vs. Prop Paper

Count	57
Num. Missing	0
|R|	.388
R Squared	.150
Adjusted R Squared	.135
RMS Residual	11.901

Regression Coefficients
Sound/conversation vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.204	2.462	11.204	4.550	<.0001
Prop Paper	.169	.054	.388	3.121	.0029

Regression Summary
Sound/fire engine vs. Prop Paper

Count	57
Num. Missing	0
|R|	.369
R Squared	.136
Adjusted R Squared	.121
RMS Residual	20.904

Regression Coefficients
Sound/fire engine vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	44.968	4.325	44.968	10.396	<.0001
Prop Paper	.280	.095	.369	2.947	.0047

Regression Summary
Sound/watch vs. Prop Paper

Count	57
Num. Missing	0
|R|	.247
R Squared	.061
Adjusted R Squared	.044
RMS Residual	4.445

Regression Coefficients
Sound/watch vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	3.119	.920	3.119	3.390	.0013
Prop Paper	.038	.020	.247	1.891	.0638

Regression Summary
Sound/whisper vs. Prop Paper

Count	57
Num. Missing	0
|R|	.339
R Squared	.115
Adjusted R Squared	.099
RMS Residual	5.125

Regression Coefficients
Sound/whisper vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	3.899	1.060	3.899	3.677	.0005
Prop Paper	.062	.023	.339	2.672	.0099

Regression Summary
Sound/airplane vs. Prop Paper

Count	57
Num. Missing	0
|R|	.213
R Squared	.045
Adjusted R Squared	.028
RMS Residual	27.797

Regression Coefficients
Sound/airplane vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	36.354	5.752	36.354	6.320	<.0001
Prop Paper	.204	.126	.213	1.617	.1116

Regression Summary
Sound/glass breaking vs. Prop Paper

Count	57
Num. Missing	0
|R|	.465
R Squared	.216
Adjusted R Squared	.202
RMS Residual	17.080

Regression Coefficients
Sound/glass breaking vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	17.566	3.534	17.566	4.970	<.0001
Prop Paper	.302	.078	.465	3.895	.0003

Regression Summary
#Sound/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.444
R Squared	.197
Adjusted R Squared	.183
RMS Residual	26.053

Regression Coefficients
#Sound/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	65.251	5.391	65.251	12.104	<.0001
Prop Paper	.435	.118	.444	3.675	.0005

Regression Summary
Bright/car turn signal vs. Prop Paper

Count	57
Num. Missing	0
|R|	.372
R Squared	.138
Adjusted R Squared	.122
RMS Residual	8.895

Regression Coefficients
Bright/car turn signal vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	6.136	1.841	6.136	3.334	.0015
Prop Paper	.120	.040	.372	2.968	.0044

Regression Summary
Bright/indoor fluor lighting vs. Prop Paper

Count	57
Num. Missing	0
|R|	.241
R Squared	.058
Adjusted R Squared	.041
RMS Residual	16.221

Regression Coefficients
Bright/indoor fluor lighting vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	17.460	3.356	17.460	5.202	<.0001
Prop Paper	.136	.074	.241	1.844	.0706

Regression Coefficients
Bright/low beam/night vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	22.861	3.369	22.861	6.785	<.0001
Prop Paper	.103	.074	.185	1.398	.1678

Regression Summary
Bright/high beam/night vs. Prop Paper

Count	57
Num. Missing	0
|R|	.203
R Squared	.041
Adjusted R Squared	.024
RMS Residual	20.686

Regression Coefficients
Bright/high beam/night vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	37.993	4.280	37.993	8.876	<.0001
Prop Paper	.144	.094	.203	1.537	.1299

Regression Summary
Bright/Xmas light vs. Prop Paper

Count	57
Num. Missing	0
|R|	.231
R Squared	.053
Adjusted R Squared	.036
RMS Residual	14.319

Regression Coefficients
Bright/Xmas light vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.321	2.963	13.321	4.496	<.0001
Prop Paper	.114	.065	.231	1.757	.0845

Regression Summary
Bright/moon vs. Prop Paper

Count	57
Num. Missing	0
|R|	.150
R Squared	.022
Adjusted R Squared	.005
RMS Residual	17.201

Regression Coefficients
Bright/moon vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	14.657	3.559	14.657	4.118	.0001
Prop Paper	.088	.078	.150	1.125	.2654

Regression Summary
Bright/sun vs. Prop Paper

Count	57
Num. Missing	0
|R|	.075
R Squared	.006
Adjusted R Squared	•
RMS Residual	46.521

Regression Coefficients
Bright/sun vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	79.611	9.626	79.611	8.270	<.0001
Prop Paper	-.118	.211	-.075	-.559	.5782

Regression Summary
Bright/amber traff light vs. Prop Paper

Count	55
Num. Missing	2
|R|	.465
R Squared	.216
Adjusted R Squared	.201
RMS Residual	11.195

Regression Coefficients
Bright/amber traff light vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	9.489	2.379	9.489	3.989	.0002
Prop Paper	.196	.051	.465	3.822	.0004

Regression Summary
Bright/green traff light vs. Prop Paper

Count	57
Num. Missing	0
|R|	.391
R Squared	.153
Adjusted R Squared	.137
RMS Residual	10.819

Regression Coefficients
Bright/green traff light vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	10.652	2.239	10.652	4.758	<.0001
Prop Paper	.155	.049	.391	3.147	.0027

Regression Summary
Bright/red traff light vs. Prop Paper

Count	57
Num. Missing	0
|R|	.448
R Squared	.201
Adjusted R Squared	.186
RMS Residual	11.471

Regression Coefficients
Bright/red traff light vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	10.902	2.373	10.902	4.593	<.0001
Prop Paper	.194	.052	.448	3.719	.0005

Regression Summary
#Bright/stongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.050
R Squared	.002
Adjusted R Squared	•
RMS Residual	42.332

Regression Coefficients
#Bright/stongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	83.521	8.759	83.521	9.535	<.0001
Prop Paper	.071	.192	.050	.370	.7127

Regression Summary
Press/slap/friendly vs. Prop Paper

Count	57
Num. Missing	0
|R|	.418
R Squared	.174
Adjusted R Squared	.159
RMS Residual	12.801

Regression Coefficients
Press/slap/friendly vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.266	2.649	11.266	4.253	<.0001
Prop Paper	.198	.058	.418	3.407	.0012

Regression Summary
Press/pat/cheek/affectionate vs. Prop Paper

Count	57
Num. Missing	0
|R|	.391
R Squared	.153
Adjusted R Squared	.137
RMS Residual	10.548

Regression Coefficients
Press/pat/cheek/affectionate vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	6.713	2.183	6.713	3.076	.0033
Prop Paper	.151	.048	.391	3.147	.0027

Regression Summary
Press/handshake vs. Prop Paper

Count	57
Num. Missing	0
|R|	.072
R Squared	.005
Adjusted R Squared	•
RMS Residual	89.613

Regression Coefficients
Press/handshake vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	19.871	18.543	19.871	1.072	.2886
Prop Paper	.217	.407	.072	.535	.5951

Regression Summary
Press/light switch vs. Prop Paper

Count	57
Num. Missing	0
|R|	.432
R Squared	.186
Adjusted R Squared	.172
RMS Residual	5.798

Regression Coefficients
Press/light switch vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	5.021	1.200	5.021	4.185	.0001
Prop Paper	.093	.026	.432	3.551	.0008

Regression Summary
#Press/strongest vs. Prop Paper

Count	56
Num. Missing	1
|R|	.115
R Squared	.013
Adjusted R Squared	•
RMS Residual	24.996

Regression Coefficients
#Press/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	53.005	5.216	53.005	10.162	<.0001
Prop Paper	.101	.118	.115	.852	.3977

Regression Summary
Pain/mild headache vs. Prop Paper

Count	56
Num. Missing	1
|R|	.090
R Squared	.008
Adjusted R Squared	•
RMS Residual	15.541

Regression Coefficients
Pain/mild headache vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	21.649	3.216	21.649	6.731	<.0001
Prop Paper	.047	.071	.090	.662	.5107

Regression Summary
Pain/severe headache vs. Prop Paper

Count	53
Num. Missing	4
|R|	.383
R Squared	.147
Adjusted R Squared	.130
RMS Residual	21.339

Regression Coefficients
Pain/severe headache vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	35.170	4.604	35.170	7.640	<.0001
Prop Paper	.296	.100	.383	2.964	.0046

Regression Summary
Pain/stubbed toe vs. Prop Paper

Count	55
Num. Missing	2
|R|	.142
R Squared	.020
Adjusted R Squared	.002
RMS Residual	20.318

Regression Coefficients
Pain/stubbed toe vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	32.707	4.370	32.707	7.484	<.0001
Prop Paper	.098	.094	.142	1.043	.3015

Regression Summary
Pain/elec shock vs. Prop Paper

Count	35
Num. Missing	22
|R|	.189
R Squared	.036
Adjusted R Squared	.007
RMS Residual	22.063

Regression Coefficients
Pain/elec shock vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	25.393	5.789	25.393	4.386	.0001
Prop Paper	.135	.122	.189	1.108	.2757

Regression Summary
#Pain/strongest vs. Prop Paper

Count	56
Num. Missing	1
|R|	.062
R Squared	.004
Adjusted R Squared	•
RMS Residual	22.397

Regression Coefficients
#Pain/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	82.505	4.686	82.505	17.606	<.0001
Prop Paper	-.049	.106	-.062	-.459	.6484

Regression Summary
Odor/lemon vs. Prop Paper

Count	57
Num. Missing	0
|R|	.302
R Squared	.091
Adjusted R Squared	.075
RMS Residual	15.051

Regression Coefficients
Odor/lemon vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.740	3.114	12.740	4.090	.0001
Prop Paper	.160	.068	.302	2.349	.0224

Regression Summary
Odor/rose vs. Prop Paper

Count	57
Num. Missing	0
|R|	.316
R Squared	.100
Adjusted R Squared	.084
RMS Residual	14.938

Regression Coefficients
Odor/rose vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.874	3.091	11.874	3.842	.0003
Prop Paper	.167	.068	.316	2.471	.0166

Regression Summary
Odor/skunk vs. Prop Paper

Count	49
Num. Missing	8
|R|	.275
R Squared	.075
Adjusted R Squared	.056
RMS Residual	19.779

Regression Coefficients
Odor/skunk vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	32.098	4.449	32.098	7.215	<.0001
Prop Paper	.196	.100	.275	1.959	.0561

Regression Summary
Odor/bacon vs. Prop Paper

Count	55
Num. Missing	2
|R|	.437
R Squared	.191
Adjusted R Squared	.175
RMS Residual	15.866

Regression Coefficients
Odor/bacon vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	16.764	3.384	16.764	4.953	<.0001
Prop Paper	.269	.076	.437	3.533	.0009

Regression Summary
Odor/bread vs. Prop Paper

Count	57
Num. Missing	0
|R|	.436
R Squared	.190
Adjusted R Squared	.175
RMS Residual	14.064

Regression Coefficients
Odor/bread vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.148	2.910	13.148	4.518	<.0001
Prop Paper	.229	.064	.436	3.591	.0007

Regression Summary
Odor/lilacs vs. Prop Paper

Count	47
Num. Missing	10
|R|	.352
R Squared	.124
Adjusted R Squared	.105
RMS Residual	15.183

Regression Coefficients
Odor/lilacs vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.173	3.528	11.173	3.167	.0028
Prop Paper	.185	.073	.352	2.525	.0152

Regression Summary
Odor/turkey vs. Prop Paper

Count	54
Num. Missing	3
|R|	.379
R Squared	.143
Adjusted R Squared	.127
RMS Residual	15.339

Regression Coefficients
Odor/turkey vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	14.904	3.313	14.904	4.498	<.0001
Prop Paper	.210	.071	.379	2.951	.0047

Regression Summary
Odor/vanilla vs. Prop Paper

Count	55
Num. Missing	2
|R|	.393
R Squared	.154
Adjusted R Squared	.139
RMS Residual	13.451

Regression Coefficients
Odor/vanilla vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	10.118	2.827	10.118	3.579	.0007
Prop Paper	.197	.063	.393	3.112	.0030

Regression Summary
Odor/cocoa vs. Prop Paper

Count	56
Num. Missing	1
|R|	.456
R Squared	.208
Adjusted R Squared	.193
RMS Residual	12.211

Regression Coefficients
Odor/cocoa vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	8.218	2.551	8.218	3.222	.0022
Prop Paper	.209	.056	.456	3.762	.0004

Regression Summary
Odor/apple cider vs. Prop Paper

Count	53
Num. Missing	4
|R|	.429
R Squared	.184
Adjusted R Squared	.168
RMS Residual	13.425

Regression Coefficients
Odor/apple cider vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	8.638	2.912	8.638	2.966	.0046
Prop Paper	.210	.062	.429	3.388	.0014

Regression Summary
#Odor/stongest vs. Prop Paper

Count	56
Num. Missing	1
|R|	.234
R Squared	.055
Adjusted R Squared	.037
RMS Residual	27.524

Regression Coefficients
#Odor/stongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	52.513	5.737	52.513	9.154	<.0001
Prop Paper	.221	.125	.234	1.766	.0831

Regression Summary
Pung/mothballs vs. Prop Paper

Count	45
Num. Missing	12
|R|	.265
R Squared	.070
Adjusted R Squared	.048
RMS Residual	18.672

Regression Coefficients
Pung/mothballs vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	24.233	4.395	24.233	5.513	<.0001
Prop Paper	.167	.093	.265	1.800	.0788

Regression Summary
Pung/ammonia vs. Prop Paper

Count	56
Num. Missing	1
|R|	.102
R Squared	.010
Adjusted R Squared	•
RMS Residual	29.115

Regression Coefficients
Pung/ammonia vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	47.239	6.110	47.239	7.731	<.0001
Prop Paper	.100	.133	.102	.752	.4554

Regression Summary
#Pung/strongest vs. Prop Paper

Count	56
Num. Missing	1
|R|	.108
R Squared	.012
Adjusted R Squared	•
RMS Residual	27.646

Regression Coefficients
#Pung/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	61.245	5.722	61.245	10.703	<.0001
Prop Paper	.101	.127	.108	.795	.4299

Regression Summary
ThermWH/hot pan vs. Prop Paper

Count	57
Num. Missing	0
|R|	.245
R Squared	.060
Adjusted R Squared	.043
RMS Residual	31.381

Regression Coefficients
ThermWH/hot pan vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	48.089	6.493	48.089	7.406	<.0001
Prop Paper	.267	.142	.245	1.875	.0661

Regression Summary
ThermWH/cat/lap vs. Prop Paper

Count	55
Num. Missing	2
|R|	.407
R Squared	.166
Adjusted R Squared	.150
RMS Residual	13.688

Regression Coefficients
ThermWH/cat/lap vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	9.890	2.891	9.890	3.421	.0012
Prop Paper	.211	.065	.407	3.243	.0020

Regression Summary
ThermWH/heating pad vs. Prop Paper

Count	54
Num. Missing	3
|R|	.347
R Squared	.120
Adjusted R Squared	.103
RMS Residual	15.257

Regression Coefficients
ThermWH/heating pad vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	18.249	3.288	18.249	5.551	<.0001
Prop Paper	.188	.070	.347	2.665	.0102

Regression Summary
ThermWH/hot bath vs. Prop Paper

Count	57
Num. Missing	0
|R|	.293
R Squared	.086
Adjusted R Squared	.069
RMS Residual	18.231

Regression Coefficients
ThermWH/hot bath vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	24.843	3.772	24.843	6.586	<.0001
Prop Paper	.188	.083	.293	2.270	.0271

Regression Summary
ThermWH/oven door vs. Prop Paper

Count	54
Num. Missing	3
|R|	.155
R Squared	.024
Adjusted R Squared	.005
RMS Residual	28.079

Regression Coefficients
ThermWH/oven door vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	38.636	6.006	38.636	6.433	<.0001
Prop Paper	.146	.129	.155	1.135	.2617

Regression Summary
ThermWH/hot bulb vs. Prop Paper

Count	57
Num. Missing	0
|R|	.095
R Squared	.009
Adjusted R Squared	•
RMS Residual	24.675

Regression Coefficients
ThermWH/hot bulb vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	42.107	5.106	42.107	8.247	<.0001
Prop Paper	.079	.112	.095	.707	.4823

Regression Summary
ThermWH/scalding water vs. Prop Paper

Count	53
Num. Missing	4
|R|	.197
R Squared	.039
Adjusted R Squared	.020
RMS Residual	31.339

Regression Coefficients
ThermWH/scalding water vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	54.556	6.710	54.556	8.131	<.0001
Prop Paper	.221	.154	.197	1.433	.1579

Regression Summary
ThermWH/sun/face vs. Prop Paper

Count	57
Num. Missing	0
|R|	.368
R Squared	.135
Adjusted R Squared	.120
RMS Residual	13.624

Regression Coefficients
ThermWH/sun/face vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	14.396	2.819	14.396	5.107	<.0001
Prop Paper	.181	.062	.368	2.934	.0049

Regression Summary
ThermWH/hands/warm water vs. Prop Paper

Count	57
Num. Missing	0
|R|	.334
R Squared	.112
Adjusted R Squared	.096
RMS Residual	14.245

Regression Coefficients
ThermWH/hands/warm water vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.823	2.948	13.823	4.690	<.0001
Prop Paper	.170	.065	.334	2.631	.0110

Regression Summary
ThermWH/barefoot/hot pavement vs. Prop Paper

Count	57
Num. Missing	0
|R|	.316
R Squared	.100
Adjusted R Squared	.084
RMS Residual	18.722

Regression Coefficients
ThermWH/barefoot/hot pavement vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	29.023	3.874	29.023	7.492	<.0001
Prop Paper	.210	.085	.316	2.472	.0165

Regression Summary
ThermWH/sunburn vs. Prop Paper

Count	50
Num. Missing	7
|R|	.315
R Squared	.099
Adjusted R Squared	.081
RMS Residual	18.444

Regression Coefficients
ThermWH/sunburn vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	26.106	3.975	26.106	6.567	<.0001
Prop Paper	.212	.092	.315	2.301	.0257

Regression Summary
#ThermWH/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.154
R Squared	.024
Adjusted R Squared	.006
RMS Residual	28.744

Regression Coefficients
#ThermWH/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	67.482	5.948	67.482	11.346	<.0001
Prop Paper	.151	.130	.154	1.159	.2515

Regression Summary
ThermC/cool washcloth vs. Prop Paper

Count	57
Num. Missing	0
|R|	.438
R Squared	.192
Adjusted R Squared	.177
RMS Residual	12.404

Regression Coefficients
ThermC/cool washcloth vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.289	2.567	12.289	4.788	<.0001
Prop Paper	.203	.056	.438	3.611	.0007

Regression Summary
ThermC/soda can vs. Prop Paper

Count	57
Num. Missing	0
|R|	.345
R Squared	.119
Adjusted R Squared	.103
RMS Residual	14.723

Regression Coefficients
ThermC/soda can vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	15.420	3.046	15.420	5.062	<.0001
Prop Paper	.182	.067	.345	2.722	.0087

Regression Summary
ThermC/ice cube/briefly vs. Prop Paper

Count	57
Num. Missing	0
|R|	.315
R Squared	.099
Adjusted R Squared	.083
RMS Residual	17.076

Regression Coefficients
ThermC/ice cube/briefly vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	14.974	3.533	14.974	4.238	<.0001
Prop Paper	.191	.077	.315	2.464	.0169

Regression Summary
ThermC/holding ice cube vs. Prop Paper

Count	57
Num. Missing	0
|R|	.280
R Squared	.079
Adjusted R Squared	.062
RMS Residual	20.948

Regression Coefficients
ThermC/holding ice cube vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	28.142	4.335	28.142	6.493	<.0001
Prop Paper	.206	.095	.280	2.167	.0346

Regression Summary
ThermC/snow vs. Prop Paper

Count	54
Num. Missing	3
|R|	.325
R Squared	.106
Adjusted R Squared	.089
RMS Residual	21.238

Regression Coefficients
ThermC/snow vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	30.822	4.440	30.822	6.941	<.0001
Prop Paper	.239	.096	.325	2.480	.0164

Regression Summary
ThermC/cool shower hot day vs. Prop Paper

Count	57
Num. Missing	0
|R|	.282
R Squared	.079
Adjusted R Squared	.063
RMS Residual	15.157

Regression Coefficients
ThermC/cool shower hot day vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	19.622	3.136	19.622	6.257	<.0001
Prop Paper	.150	.069	.282	2.178	.0337

Regression Summary
ThermC/cold floor tiles barefoot vs. Prop Paper

Count	56
Num. Missing	1
|R|	.361
R Squared	.131
Adjusted R Squared	.114
RMS Residual	14.631

Regression Coefficients
ThermC/cold floor tiles barefoot vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	15.669	3.056	15.669	5.127	<.0001
Prop Paper	.190	.067	.361	2.848	.0062

Regression Summary
ThermC/cold tap water vs. Prop Paper

Count	57
Num. Missing	0
|R|	.360
R Squared	.129
Adjusted R Squared	.114
RMS Residual	14.153

Regression Coefficients
ThermC/cold tap water vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	15.397	2.928	15.397	5.258	<.0001
Prop Paper	.184	.064	.360	2.860	.0060

Regression Summary
ThermC/room temp silverware vs. Prop Paper

Count	55
Num. Missing	2
|R|	.345
R Squared	.119
Adjusted R Squared	.103
RMS Residual	8.964

Regression Coefficients
ThermC/room temp silverware vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	4.621	1.928	4.621	2.397	.0201
Prop Paper	.111	.042	.345	2.680	.0098

Regression Summary
#ThermC/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.178
R Squared	.032
Adjusted R Squared	.014
RMS Residual	26.498

Regression Coefficients
#ThermC/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	57.908	5.483	57.908	10.561	<.0001
Prop Paper	.161	.120	.178	1.341	.1855

Regression Summary
Flavor/chocolate vs. Prop Paper

Count	57
Num. Missing	0
|R|	.524
R Squared	.275
Adjusted R Squared	.262
RMS Residual	14.932

Regression Coefficients
Flavor/chocolate vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	14.573	3.090	14.573	4.716	<.0001
Prop Paper	.309	.068	.524	4.567	<.0001

Regression Summary
Flavor/peanut butter vs. Prop Paper

Count	56
Num. Missing	1
|R|	.453
R Squared	.206
Adjusted R Squared	.191
RMS Residual	15.753

Regression Coefficients
Flavor/peanut butter vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	15.039	3.263	15.039	4.609	<.0001
Prop Paper	.268	.072	.453	3.738	.0004

Regression Summary
Flavor/vanilla vs. Prop Paper

Count	57
Num. Missing	0
|R|	.434
R Squared	.188
Adjusted R Squared	.173
RMS Residual	12.170

Regression Coefficients
Flavor/vanilla vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	10.966	2.518	10.966	4.355	<.0001
Prop Paper	.197	.055	.434	3.569	.0008

Regression Summary
Flavor/strawberry vs. Prop Paper

Count	56
Num. Missing	1
|R|	.538
R Squared	.290
Adjusted R Squared	.277
RMS Residual	14.533

Regression Coefficients
Flavor/strawberry vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.979	3.010	12.979	4.312	<.0001
Prop Paper	.310	.066	.538	4.694	<.0001

Regression Summary
#Flavor/strongest vs. Prop Paper

Count	56
Num. Missing	1
|R|	.357
R Squared	.128
Adjusted R Squared	.112
RMS Residual	23.631

Regression Coefficients
#Flavor/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	42.020	4.912	42.020	8.554	<.0001
Prop Paper	.302	.107	.357	2.812	.0069

Regression Summary
Salt/potato chip vs. Prop Paper

Count	57
Num. Missing	0
|R|	.605
R Squared	.366
Adjusted R Squared	.354
RMS Residual	12.110

Regression Coefficients
Salt/potato chip vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.124	2.506	13.124	5.237	<.0001
Prop Paper	.310	.055	.605	5.634	<.0001

Regression Summary
Salt/pretzel vs. Prop Paper

Count	54
Num. Missing	3
|R|	.554
R Squared	.307
Adjusted R Squared	.293
RMS Residual	13.761

Regression Coefficients
Salt/pretzel vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.900	2.941	12.900	4.387	<.0001
Prop Paper	.305	.064	.554	4.797	<.0001

Regression Summary
Salt/salt vs. Prop Paper

Count	57
Num. Missing	0
|R|	.516
R Squared	.266
Adjusted R Squared	.253
RMS Residual	22.524

Regression Coefficients
Salt/salt vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	27.834	4.661	27.834	5.972	<.0001
Prop Paper	.457	.102	.516	4.469	<.0001

Regression Summary
Salt/sea water vs. Prop Paper

Count	53
Num. Missing	4
|R|	.526
R Squared	.277
Adjusted R Squared	.263
RMS Residual	21.395

Regression Coefficients
Salt/sea water vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	22.842	4.594	22.842	4.973	<.0001
Prop Paper	.463	.105	.526	4.421	<.0001

Regression Summary
Salt/soup broth vs. Prop Paper

Count	56
Num. Missing	1
|R|	.467
R Squared	.218
Adjusted R Squared	.204
RMS Residual	12.453

Regression Coefficients
Salt/soup broth vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.203	2.608	12.203	4.679	<.0001
Prop Paper	.220	.057	.467	3.883	.0003

Regression Summary
Salt/olive vs. Prop Paper

Count	47
Num. Missing	10
|R|	.308
R Squared	.095
Adjusted R Squared	.074
RMS Residual	18.739

Regression Coefficients
Salt/olive vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	17.099	4.329	17.099	3.950	.0003
Prop Paper	.199	.092	.308	2.168	.0355

Regression Summary
#Salt/stongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.530
R Squared	.281
Adjusted R Squared	.267
RMS Residual	22.148

Regression Coefficients
#Salt/stongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	32.736	4.583	32.736	7.143	<.0001
Prop Paper	.465	.101	.530	4.631	<.0001

Regression Summary
Sour/dill pickle vs. Prop Paper

Count	52
Num. Missing	5
|R|	.529
R Squared	.279
Adjusted R Squared	.265
RMS Residual	14.126

Regression Coefficients
Sour/dill pickle vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.016	3.150	13.016	4.133	.0001
Prop Paper	.294	.067	.529	4.403	<.0001

Regression Summary
Sour/lemon vs. Prop Paper

Count	57
Num. Missing	0
|R|	.548
R Squared	.301
Adjusted R Squared	.288
RMS Residual	20.867

Regression Coefficients
Sour/lemon vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	24.115	4.318	24.115	5.585	<.0001
Prop Paper	.460	.095	.548	4.861	<.0001

Regression Summary
Sour/sourdough bread vs. Prop Paper

Count	50
Num. Missing	7
|R|	.480
R Squared	.230
Adjusted R Squared	.214
RMS Residual	12.167

Regression Coefficients
Sour/sourdough bread vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	6.631	2.714	6.631	2.444	.0183
Prop Paper	.226	.060	.480	3.792	.0004

Regression Summary
Sour/vinegar vs. Prop Paper

Count	55
Num. Missing	2
|R|	.570
R Squared	.325
Adjusted R Squared	.312
RMS Residual	20.124

Regression Coefficients
Sour/vinegar vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	24.431	4.214	24.431	5.797	<.0001
Prop Paper	.463	.092	.570	5.052	<.0001

Regression Summary
Sour/sour ball vs. Prop Paper

Count	51
Num. Missing	6
|R|	.601
R Squared	.361
Adjusted R Squared	.348
RMS Residual	21.674

Regression Coefficients
Sour/sour ball vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	21.310	4.981	21.310	4.278	<.0001
Prop Paper	.546	.104	.601	5.267	<.0001

Regression Summary
#Sour/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.569
R Squared	.323
Adjusted R Squared	.311
RMS Residual	21.714

Regression Coefficients
#Sour/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	32.769	4.493	32.769	7.293	<.0001
Prop Paper	.505	.099	.569	5.125	<.0001

Regression Summary
Sweet/banana vs. Prop Paper

Count	57
Num. Missing	0
|R|	.413
R Squared	.171
Adjusted R Squared	.155
RMS Residual	10.268

Regression Coefficients
Sweet/banana vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.028	2.125	11.028	5.191	<.0001
Prop Paper	.157	.047	.413	3.363	.0014

Regression Summary
Sweet/cherry lifesaver vs. Prop Paper

Count	55
Num. Missing	2
|R|	.493
R Squared	.243
Adjusted R Squared	.229
RMS Residual	17.084

Regression Coefficients
Sweet/cherry lifesaver vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	15.366	3.656	15.366	4.203	.0001
Prop Paper	.326	.079	.493	4.130	.0001

Regression Summary
Sweet/coke vs. Prop Paper

Count	56
Num. Missing	1
|R|	.327
R Squared	.107
Adjusted R Squared	.090
RMS Residual	17.156

Regression Coefficients
Sweet/coke vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	19.643	3.609	19.643	5.442	<.0001
Prop Paper	.199	.078	.327	2.541	.0139

Regression Summary
Sweet/red apple vs. Prop Paper

Count	57
Num. Missing	0
|R|	.343
R Squared	.118
Adjusted R Squared	.102
RMS Residual	11.518

Regression Coefficients
Sweet/red apple vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	10.810	2.383	10.810	4.536	<.0001
Prop Paper	.142	.052	.343	2.708	.0090

Regression Summary
Sweet/cotton candy vs. Prop Paper

Count	55
Num. Missing	2
|R|	.514
R Squared	.264
Adjusted R Squared	.250
RMS Residual	20.044

Regression Coefficients
Sweet/cotton candy vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	22.191	4.238	22.191	5.236	<.0001
Prop Paper	.399	.092	.514	4.359	<.0001

Regression Summary
Sweet/Hershey car vs. Prop Paper

Count	57
Num. Missing	0
|R|	.434
R Squared	.188
Adjusted R Squared	.173
RMS Residual	17.438

Regression Coefficients
Sweet/Hershey car vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	19.301	3.608	19.301	5.349	<.0001
Prop Paper	.282	.079	.434	3.569	.0008

Regression Summary
Sweet/honey vs. Prop Paper

Count	55
Num. Missing	2
|R|	.477
R Squared	.228
Adjusted R Squared	.213
RMS Residual	19.991

Regression Coefficients
Sweet/honey vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	25.060	4.186	25.060	5.986	<.0001
Prop Paper	.360	.091	.477	3.954	.0002

Regression Summary
Sweet/sugar vs. Prop Paper

Count	56
Num. Missing	1
|R|	.488
R Squared	.238
Adjusted R Squared	.224
RMS Residual	21.335

Regression Coefficients
Sweet/sugar vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	27.310	4.457	27.310	6.127	<.0001
Prop Paper	.399	.097	.488	4.112	.0001

Regression Summary
Sweet/carrot vs. Prop Paper

Count	55
Num. Missing	2
|R|	.324
R Squared	.105
Adjusted R Squared	.088
RMS Residual	6.389

Regression Coefficients
Sweet/carrot vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	4.378	1.349	4.378	3.244	.0020
Prop Paper	.073	.029	.324	2.495	.0158

Regression Summary
#Sweet/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.599
R Squared	.359
Adjusted R Squared	.347
RMS Residual	20.550

Regression Coefficients
#Sweet/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	32.767	4.252	32.767	7.706	<.0001
Prop Paper	.517	.093	.599	5.547	<.0001

Regression Summary
Bitter/blackcoffee vs. Prop Paper

Count	51
Num. Missing	6
|R|	.522
R Squared	.273
Adjusted R Squared	.258
RMS Residual	20.926

Regression Coefficients
Bitter/blackcoffee vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	18.237	4.685	18.237	3.893	.0003
Prop Paper	.436	.102	.522	4.285	<.0001

Regression Summary
Bitter/celery vs. Prop Paper

Count	53
Num. Missing	4
|R|	.374
R Squared	.140
Adjusted R Squared	.123
RMS Residual	13.908

Regression Coefficients
Bitter/celery vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	3.711	3.036	3.711	1.222	.2272
Prop Paper	.187	.065	.374	2.881	.0058

Regression Summary
Bitter/dark chocolte vs. Prop Paper

Count	56
Num. Missing	1
|R|	.352
R Squared	.124
Adjusted R Squared	.107
RMS Residual	17.452

Regression Coefficients
Bitter/dark chocolte vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.918	3.678	11.918	3.240	.0020
Prop Paper	.221	.080	.352	2.761	.0079

Regression Summary
Bitter/beer vs. Prop Paper

Count	50
Num. Missing	7
|R|	.496
R Squared	.246
Adjusted R Squared	.230
RMS Residual	15.794

Regression Coefficients
Bitter/beer vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.389	3.440	11.389	3.311	.0018
Prop Paper	.303	.077	.496	3.958	.0002

Regression Summary
Bitter/aspirin vs. Prop Paper

Count	51
Num. Missing	6
|R|	.434
R Squared	.188
Adjusted R Squared	.172
RMS Residual	20.980

Regression Coefficients
Bitter/aspirin vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	18.942	4.471	18.942	4.237	<.0001
Prop Paper	.335	.099	.434	3.373	.0015

Regression Summary
Bitter/grapefruit juice vs. Prop Paper

Count	54
Num. Missing	3
|R|	.463
R Squared	.215
Adjusted R Squared	.200
RMS Residual	20.244

Regression Coefficients
Bitter/grapefruit juice vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	16.192	4.287	16.192	3.777	.0004
Prop Paper	.351	.093	.463	3.772	.0004

Regression Summary
#Bitter/strongest vs. Prop Paper

Count	56
Num. Missing	1
|R|	.498
R Squared	.248
Adjusted R Squared	.234
RMS Residual	22.667

Regression Coefficients
#Bitter/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	35.738	4.701	35.738	7.602	<.0001
Prop Paper	.435	.103	.498	4.223	<.0001

Regression Summary
OBurn/mint toothpaste vs. Prop Paper

Count	57
Num. Missing	0
|R|	.114
R Squared	.013
Adjusted R Squared	•
RMS Residual	12.082

Regression Coefficients
OBurn/mint toothpaste vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.768	2.500	12.768	5.107	<.0001
Prop Paper	.047	.055	.114	.854	.3971

Regression Summary
OBurn/cinnamon gum vs. Prop Paper

Count	57
Num. Missing	0
|R|	.326
R Squared	.107
Adjusted R Squared	.090
RMS Residual	17.245

Regression Coefficients
OBurn/cinnamon gum vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.377	3.568	12.377	3.469	.0010
Prop Paper	.200	.078	.326	2.561	.0132

Regression Summary
OBurn/jalapeno vs. Prop Paper

Count	53
Num. Missing	4
|R|	.276
R Squared	.076
Adjusted R Squared	.058
RMS Residual	26.311

Regression Coefficients
OBurn/jalapeno vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	37.549	5.804	37.549	6.470	<.0001
Prop Paper	.252	.123	.276	2.049	.0456

Regression Summary
OBurn/medium salsa vs. Prop Paper

Count	56
Num. Missing	1
|R|	.318
R Squared	.101
Adjusted R Squared	.084
RMS Residual	16.703

Regression Coefficients
OBurn/medium salsa vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	18.321	3.522	18.321	5.201	<.0001
Prop Paper	.188	.077	.318	2.461	.0171

Regression Summary
OBurn/hot salsa vs. Prop Paper

Count	56
Num. Missing	1
|R|	.393
R Squared	.154
Adjusted R Squared	.138
RMS Residual	22.330

Regression Coefficients
OBurn/hot salsa vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	29.237	4.709	29.237	6.209	<.0001
Prop Paper	.321	.102	.393	3.136	.0028

Regression Summary
OBurn/yellow mustard vs. Prop Paper

Count	54
Num. Missing	3
|R|	.254
R Squared	.065
Adjusted R Squared	.047
RMS Residual	15.946

Regression Coefficients
OBurn/yellow mustard vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.096	3.416	12.096	3.541	.0009
Prop Paper	.140	.074	.254	1.895	.0636

Regression Summary
OBurn/cola vs. Prop Paper

Count	57
Num. Missing	0
|R|	.352
R Squared	.124
Adjusted R Squared	.108
RMS Residual	13.288

Regression Coefficients
OBurn/cola vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	8.914	2.750	8.914	3.242	.0020
Prop Paper	.168	.060	.352	2.786	.0073

Regression Summary
OBurn/ginger cookie vs. Prop Paper

Count	46
Num. Missing	11
|R|	.166
R Squared	.027
Adjusted R Squared	.005
RMS Residual	14.287

Regression Coefficients
OBurn/ginger cookie vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	8.022	3.181	8.022	2.521	.0154
Prop Paper	.077	.069	.166	1.114	.2712

Regression Summary
#OBurn/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.279
R Squared	.078
Adjusted R Squared	.061
RMS Residual	27.727

Regression Coefficients
#OBurn/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	53.956	5.737	53.956	9.404	<.0001
Prop Paper	.271	.126	.279	2.155	.0356

Regression Summary
OPain/biting tongue vs. Prop Paper

Count	57
Num. Missing	0
|R|	.269
R Squared	.073
Adjusted R Squared	.056
RMS Residual	22.953

Regression Coefficients
OPain/biting tongue vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	35.246	4.749	35.246	7.421	<.0001
Prop Paper	.216	.104	.269	2.074	.0428

Regression Summary
OPain/toothache vs. Prop Paper

Count	49
Num. Missing	8
|R|	.244
R Squared	.060
Adjusted R Squared	.039
RMS Residual	25.656

Regression Coefficients
OPain/toothache vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	36.512	5.661	36.512	6.450	<.0001
Prop Paper	.219	.127	.244	1.724	.0912

Regression Summary
OPain/canker sore vs. Prop Paper

Count	46
Num. Missing	11
|R|	.260
R Squared	.067
Adjusted R Squared	.046
RMS Residual	24.395

Regression Coefficients
OPain/canker sore vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	27.828	5.533	27.828	5.030	<.0001
Prop Paper	.216	.121	.260	1.783	.0815

Regression Summary
#OPain/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.019
R Squared	3.449E-4
Adjusted R Squared	•
RMS Residual	44.812

Regression Coefficients
#OPain/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	69.983	9.272	69.983	7.547	<.0001
Prop Paper	-.028	.203	-.019	-.138	.8909

Regression Summary
OralWH/hot tea/coffee vs. Prop Paper

Count	57
Num. Missing	0
|R|	.272
R Squared	.074
Adjusted R Squared	.057
RMS Residual	22.452

Regression Coefficients
OralWH/hot tea/coffee vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	28.071	4.646	28.071	6.042	<.0001
Prop Paper	.213	.102	.272	2.092	.0410

Regression Summary
OralWH/warm bread vs. Prop Paper

Count	57
Num. Missing	0
|R|	.438
R Squared	.192
Adjusted R Squared	.177
RMS Residual	13.377

Regression Coefficients
OralWH/warm bread vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.092	2.768	11.092	4.007	.0002
Prop Paper	.219	.061	.438	3.612	.0007

Regression Summary
OralWH/hot pizza vs. Prop Paper

Count	56
Num. Missing	1
|R|	.285
R Squared	.081
Adjusted R Squared	.064
RMS Residual	24.865

Regression Coefficients
OralWH/hot pizza vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	40.130	5.194	40.130	7.726	<.0001
Prop Paper	.247	.113	.285	2.186	.0332

Regression Summary
#OralWH/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.239
R Squared	.057
Adjusted R Squared	.040
RMS Residual	25.922

Regression Coefficients
#OralWH/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	48.433	5.364	48.433	9.030	<.0001
Prop Paper	.214	.118	.239	1.822	.0738

Regression Summary
OralC/ice cube vs. Prop Paper

Count	57
Num. Missing	0
|R|	.295
R Squared	.087
Adjusted R Squared	.070
RMS Residual	18.141

Regression Coefficients
OralC/ice cube vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	31.302	3.754	31.302	8.339	<.0001
Prop Paper	.188	.082	.295	2.288	.0260

Regression Summary
OralC/tongue to ice vs. Prop Paper

Count	57
Num. Missing	0
|R|	.376
R Squared	.141
Adjusted R Squared	.126
RMS Residual	19.560

Regression Coefficients
OralC/tongue to ice vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	23.708	4.047	23.708	5.857	<.0001
Prop Paper	.267	.089	.376	3.009	.0039

Regression Summary
OralC/room temp H2O vs. Prop Paper

Count	56
Num. Missing	1
|R|	.352
R Squared	.124
Adjusted R Squared	.108
RMS Residual	10.711

Regression Coefficients
OralC/room temp H2O vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	6.239	2.217	6.239	2.814	.0068
Prop Paper	.135	.049	.352	2.767	.0077

Regression Summary
#OralC/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.321
R Squared	.103
Adjusted R Squared	.086
RMS Residual	21.379

Regression Coefficients
#OralC/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	41.226	4.424	41.226	9.319	<.0001
Prop Paper	.243	.097	.321	2.510	.0151

Regression Summary
FlOdor/violet vs. Prop Paper

Count	51
Num. Missing	6
|R|	.284
R Squared	.081
Adjusted R Squared	.062
RMS Residual	12.197

Regression Coefficients
FlOdor/violet vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	8.769	2.679	8.769	3.273	.0020
Prop Paper	.124	.060	.284	2.077	.0430

Regression Summary
FlOdor/lilac vs. Prop Paper

Count	49
Num. Missing	8
|R|	.328
R Squared	.107
Adjusted R Squared	.088
RMS Residual	16.816

Regression Coefficients
FlOdor/lilac vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.399	3.845	13.399	3.485	.0011
Prop Paper	.192	.081	.328	2.377	.0216

Regression Summary
FlOdor/rose vs. Prop Paper

Count	57
Num. Missing	0
|R|	.442
R Squared	.196
Adjusted R Squared	.181
RMS Residual	14.742

Regression Coefficients
FlOdor/rose vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.026	3.050	11.026	3.615	.0007
Prop Paper	.245	.067	.442	3.657	.0006

Regression Summary
#FlOdor/strongest vs. Prop Paper

Count	54
Num. Missing	3
|R|	.373
R Squared	.139
Adjusted R Squared	.122
RMS Residual	20.606

Regression Coefficients
#FlOdor/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	21.545	4.401	21.545	4.895	<.0001
Prop Paper	.274	.095	.373	2.895	.0055

Regression Summary
FrOdor/orange vs. Prop Paper

Count	57
Num. Missing	0
|R|	.464
R Squared	.215
Adjusted R Squared	.201
RMS Residual	17.085

Regression Coefficients
FrOdor/orange vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	12.327	3.535	12.327	3.487	.0010
Prop Paper	.301	.078	.464	3.886	.0003

Regression Summary
FrOdor/banana vs. Prop Paper

Count	56
Num. Missing	1
|R|	.425
R Squared	.180
Adjusted R Squared	.165
RMS Residual	13.163

Regression Coefficients
FrOdor/banana vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	8.809	2.725	8.809	3.233	.0021
Prop Paper	.206	.060	.425	3.445	.0011

Regression Summary
FrOdor/pear vs. Prop Paper

Count	55
Num. Missing	2
|R|	.358
R Squared	.128
Adjusted R Squared	.111
RMS Residual	10.402

Regression Coefficients
FrOdor/pear vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	6.916	2.193	6.916	3.153	.0027
Prop Paper	.133	.048	.358	2.787	.0074

Regression Summary
#FrOdor/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.535
R Squared	.286
Adjusted R Squared	.273
RMS Residual	17.954

Regression Coefficients
#FrOdor/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	17.971	3.715	17.971	4.837	<.0001
Prop Paper	.382	.081	.535	4.694	<.0001

Regression Summary
SweetBev/lemonade vs. Prop Paper

Count	56
Num. Missing	1
|R|	.372
R Squared	.138
Adjusted R Squared	.122
RMS Residual	18.102

Regression Summary
SweetBev/comm iced tea vs. Prop Paper

Count	54
Num. Missing	3
|R|	.284
R Squared	.081
Adjusted R Squared	.063
RMS Residual	15.689

Regression Coefficients
SweetBev/comm iced tea vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	21.066	3.335	21.066	6.316	<.0001
Prop Paper	.159	.074	.284	2.138	.0373

Regression Summary
SweetBev/Pepsi vs. Prop Paper

Count	56
Num. Missing	1
|R|	.415
R Squared	.172
Adjusted R Squared	.157
RMS Residual	17.039

Regression Coefficients
SweetBev/Pepsi vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	20.851	3.585	20.851	5.817	<.0001
Prop Paper	.261	.078	.415	3.352	.0015

Regression Summary
#Sweetbev/strongest vs. Prop Paper

Count	57
Num. Missing	0
|R|	.376
R Squared	.141
Adjusted R Squared	.125
RMS Residual	20.827

Regression Coefficients
#Sweetbev/strongest vs. Prop Paper

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	33.817	4.309	33.817	7.847	<.0001
Prop Paper	.284	.095	.376	3.006	.0040

Appendix 4

ANOVAs:
Nonoral sensations by PROP groups
Sweet, salty, sour and bitter taste sensations by PROP groups

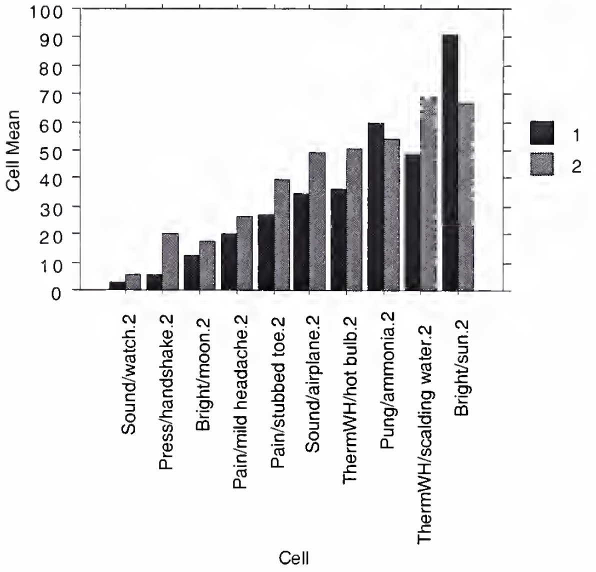
ANOVA Table for non oral ANOVA

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
PROP NT(<6)=1 ST(>50)=2	1	2080.107	2080.107	.640	.4326	.640	.115
Subject(Group)	21	68246.166	3249.817				
Category for non oral ANOVA	9	115210.880	12801.209	19.120	<.0001	172.077	1.000
Category for non oral ANOVA * PROP NT(<...	9	8877.944	986.438	1.473	.1603	13.260	.689
Category for non oral ANOVA * Subject(Gr...	189	126541.656	669.533				

Means Table for non oral ANOVA
Effect: Category for non oral ANOVA * PROP NT(<6)=1 ST(>50)=2

	Count	Mean	Std. Dev.	Std. Err.
1, Sound/watch.2	11	2.466	3.144	.948
1, Press/handshake.2	11	5.729	3.369	1.016
1, Bright/moon.2	11	12.743	15.320	4.619
1, Pain/mild headache.2	11	20.218	24.097	7.266
1, Pain/stubbed toe.2	11	27.193	23.463	7.074
1, Sound/airplane.2	11	34.963	27.596	8.320
1, ThermWH/hot bulb.2	11	36.222	24.471	7.378
1, Pung/ammonia.2	11	59.579	44.667	13.467
1, ThermWH/scalding water.2	11	48.395	34.613	10.436
1, Bright/sun.2	11	91.190	84.839	25.580
2, Sound/watch.2	12	5.637	5.155	1.488
2, Press/handshake.2	12	20.420	11.560	3.337
2, Bright/moon.2	12	17.498	12.929	3.732
2, Pain/mild headache.2	12	26.087	16.136	4.658
2, Pain/stubbed toe.2	12	39.917	16.944	4.891
2, Sound/airplane.2	12	49.191	23.474	6.776
2, ThermWH/hot bulb.2	12	50.560	29.688	8.570
2, Pung/ammonia.2	12	54.484	29.331	8.467
2, ThermWH/scalding water.2	12	68.745	33.764	9.747
2, Bright/sun.2	12	66.363	38.164	11.017

Interaction Bar Plot for non oral ANOVA
Effect: Category for non oral ANOVA * PROP NT(<6)=1 ST(>50)=2



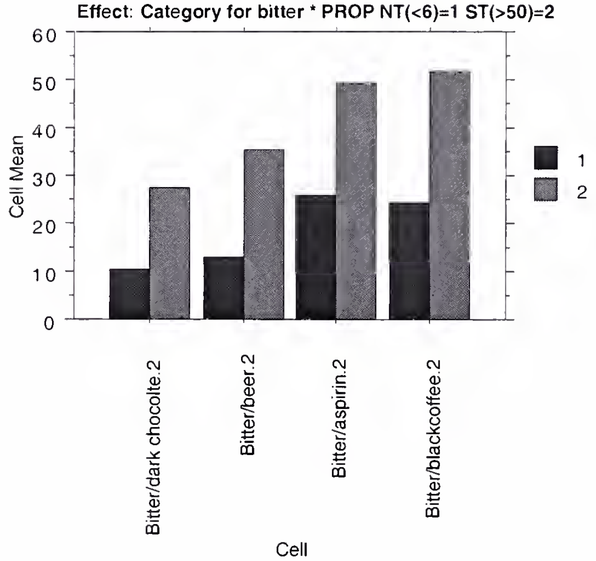
ANOVA Table for bitter

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
PROP NT(<6)=1 ST(>50)=2	1	11580.819	11580.819	7.489	.0124	7.489	.749
Subject(Group)	21	32475.465	1546.451				
Category for bitter	3	6372.322	2124.107	11.253	<.0001	33.759	1.000
Category for bitter * PROP NT(<6)=1 ST(>...	3	331.100	110.367	.585	.6273	1.754	.161
Category for bitter * Subject(Group)	63	11891.700	188.757				

Means Table for bitter
Effect: Category for bitter * PROP NT(<6)=1 ST(>50)=2

	Count	Mean	Std. Dev.	Std. Err.
1, Bitter/dark chocolte.2	11	10.562	12.713	3.833
1, Bitter/beer.2	11	12.853	15.027	4.531
1, Bitter/aspirin.2	11	26.004	26.410	7.963
1, Bitter/blackcoffee.2	11	24.301	19.881	5.994
2, Bitter/dark chocolte.2	12	27.422	23.415	6.759
2, Bitter/beer.2	12	35.273	24.080	6.951
2, Bitter/aspirin.2	12	49.003	28.113	8.115
2, Bitter/blackcoffee.2	12	51.863	27.738	8.007

Interaction Bar Plot for bitter
Effect: Category for bitter * PROP NT(<6)=1 ST(>50)=2

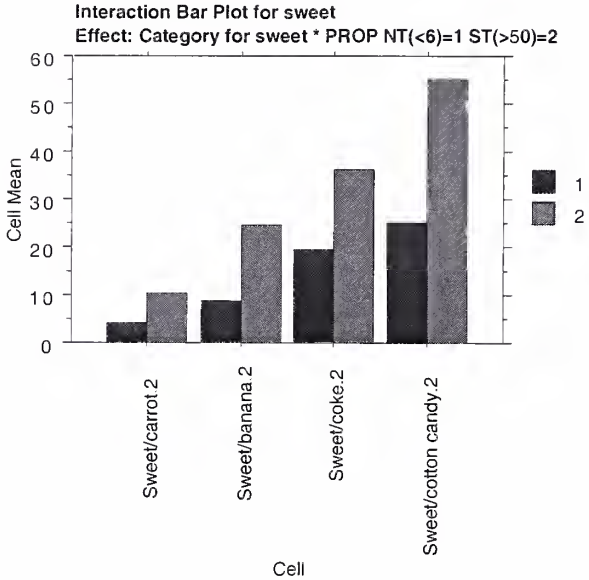


ANOVA Table for sweet

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
PROP NT(<6)=1 ST(>50)=2	1	8225.470	8225.470	12.255	.0017	12.255	.937
Subject(Group)	26	17450.543	671.175				
Category for sweet	3	16537.153	5512.384	51.569	<.0001	154.707	1.000
Category for sweet * PROP NT(<6)=1 ST(>...	3	1973.317	657.772	6.154	.0008	18.461	.964
Category for sweet * Subject(Group)	78	8337.693	106.894				

Means Table for sweet
Effect: Category for sweet * PROP NT(<6)=1 ST(>50)=2

	Count	Mean	Std. Dev.	Std. Err.
1, Sweet/carrot.2	13	4.188	5.950	1.650
1, Sweet/banana.2	13	8.662	8.226	2.281
1, Sweet/coke.2	13	19.765	17.462	4.843
1, Sweet/cotton candy.2	13	24.845	22.980	6.374
2, Sweet/carrot.2	15	10.507	9.188	2.372
2, Sweet/banana.2	15	24.624	12.956	3.345
2, Sweet/coke.2	15	36.255	17.578	4.538
2, Sweet/cotton candy.2	15	54.808	21.873	5.648



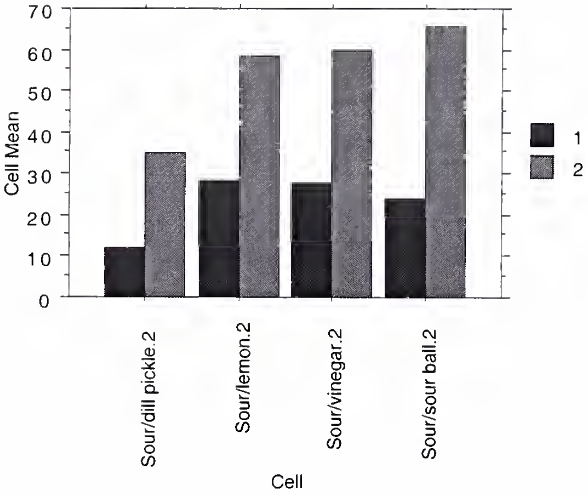
ANOVA Table for sour

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
PROP NT(<6)=1 ST(>50)=2	1	21018.489	21018.489	12.369	.0020	12.369	.934
Subject(Group)	21	35684.307	1699.253				
Category for sour	3	6411.633	2137.211	15.090	<.0001	45.270	1.000
Category for sour * PROP NT(<6)=1 ST(>5...	3	958.109	319.370	2.255	.0906	6.765	.536
Category for sour * Subject(Group)	63	8922.699	141.630				

Means Table for sour
Effect: Category for sour * PROP NT(<6)=1 ST(>50)=2

	Count	Mean	Std. Dev.	Std. Err.
1, Sour/dill pickle.2	8	12.391	14.152	5.004
1, Sour/lemon.2	8	28.029	26.270	9.288
1, Sour/vinegar.2	8	27.558	21.202	7.496
1, Sour/sour ball.2	8	23.960	19.077	6.745
2, Sour/dill pickle.2	15	35.017	16.883	4.359
2, Sour/lemon.2	15	58.558	26.597	6.867
2, Sour/vinegar.2	15	59.655	26.598	6.868
2, Sour/sour ball.2	15	65.649	25.188	6.503

Interaction Bar Plot for sour
Effect: Category for sour * PROP NT(<6)=1 ST(>50)=2



ANOVA Table for salty

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
PROP NT(<6)=1 ST(>50)=2	1	13535.033	13535.033	8.321	.0095	8.321	.791
Subject(Group)	19	30904.737	1626.565				
Category for salty	3	8703.530	2901.177	19.742	<.0001	59.226	1.000
Category for salty * PROP NT(<6)=1 ST(>5...	3	937.833	312.611	2.127	.1068	6.382	.506
Category for salty * Subject(Group)	57	8376.449	146.955				

Means Table for salty
Effect: Category for salty * PROP NT(<6)=1 ST(>50)=2

	Count	Mean	Std. Dev.	Std. Err.
1, Salt/olive.2	10	14.952	14.882	4.706
1, Salt/potato chip.2	10	12.533	14.034	4.438
1, Salt/salt.2	10	28.707	26.524	8.388
1, Salt/sea water.2	10	27.848	20.346	6.434
2, Salt/olive.2	11	29.875	19.160	5.777
2, Salt/potato chip.2	11	36.975	18.301	5.518
2, Salt/salt.2	11	60.913	29.008	8.746
2, Salt/sea water.2	11	57.943	31.659	9.545

Interaction Bar Plot for salty
Effect: Category for salty * PROP NT(<6)=1 ST(>50)=2